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The development of a master plan for the programs of industrial technology in the federal universities of technology in Nigeria

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THE DEVELOPMENT OF A MASTER PLAN FOR THE PROGRAMS OF INDUSTRIAL TECHNOLOGY IN THE FEDERAL UNIVERSITIES OF TECHNOLOGY IN NIGERIA

Iowa State University PH.D. 1983

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The development of a master plan for the programs of industrial technology in the federal universities of technology in Nigeria

by

John Nwabueze Ogbazi

A Dissertation Submitted to the
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For the Major Department

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For the Graduate College

Iowa State University
Ames, Iowa

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DEDICATION

This doctoral dissertation is wholeheartedly dedicated to the one I respect a great deal, one who shaped my life, one who has special interest and pride in and love for me, one who sent me to school and sponsored by entire education--my elder brother

PRINCE PETER NWOYE CHUKWUEMEKA OGBAZI

and

to my companion, whose encouragement and sincere love carried me through my graduate work and other endeavors--my beautiful wife, Joy Ukamaka.

--Nwabueze--

CHAPTER I. INTRODUCTION

Industrial development is a key to increased national prosperity. Today in Nigeria, many new industries are producing a wide variety of goods that formerly had to be imported from overseas. Despite this rapid industrial expansion, Nigeria still lacks sufficient young men and women with appropriate skills, abilities and trained capabilities needed for the production of goods and services that can compete favorably in the world market.

The rapid strides in science and technology have contributed immensely to the emergence of new industries. Consequently, this change in technology has given rise to training and retraining needs of industrial workers. Such needs can only be met with a considerable measure of success if there is a close cooperation among industry, labor and education in planning appropriate educational programs.

It is important to note that the government of the former Eastern Nigeria had been in the forefront in championing the Nigerian cause with respect to keeping abreast of changing technology through educational planning. In 1964, this government saw an actual need to:

> ...evolve a policy, a system of education which will produce men and women who will not be out of place in a technological age, a system which will ensure uniform standards, a system which will feed our industries with personnel without starving our schools, colleges, the church and offices of such personnel, a system

> which will produce useful, self-confident and competent citizens (Ministry of Education, Eastern Nigeria Education Handbook, 1964, p. 16).

There is no doubt that cooperation among industry, labor and education in educational planning will facilitate the establishment of quality technical programs that will keep abreast of community and industrial trends. Keller (1955) recognized the value of industry-education cooperation when he wrote:

> No high school can be comprehensive unless it is supported and approved by employers, employees, and self-employed persons in all fields of work in the community. Without such advice, the school inevitably carries on a life preparatory program that excludes the substance that could and should be (Keller, 1955, p. 191).

Wolansky (1981) advocated for a close partnership between industry and education to create an essential and capable work force for Nigeria. According to him, this partnership would contribute to enhancing the development of human resources in Nigeria. He added:

> A pool of skilled manpower using appropriate technology would be better equipped to convert the rich natural resources into useful goods and maintain peak productivity of all Nigerians (Wolansky, 1981, p. 1).

Carey (1964), while endorsing the desirability of industry and education cooperation had this to say:

> Business leaders should help schools and colleges to know the number and kind of jobs available right now. Data covering jobs most likely to be open five, ten and twenty years from now, and how many workers are qualified to fill these jobs should be considered (Carey, 1964, p. 4).

There is no gain-saying, therefore, in the fact that:

> A lack of contact between schools and industry frequently results in students learning outdated skills, having limited employment information, and a mismatch between trained workers and available skilled job opportunities (Wolansky, 1981, p. 12).

There is no other way colleges and universities in Nigeria can determine and offer educational programs attuned to the needs of industry and labor except through close communication with each other. It is through cooperation that industry gains desired facilities, participates in the training of their potential employees, and above all, gains a substantial reduction in training costs.

Traditionally, adults selected curriculum content which was drawn from the disciplines and organized in keeping with adults' view of the most functional division of information (Unruh, 1975). Nigeria is no exception to this tradition. This problem is compounded in some countries, especially developing countries, by the fact that their educational systems were transferred from the exterior and therefore are grossly out of phase with the real needs of the country. However, some developing countries are beginning to organize their curricula in accordance with regional needs assessment and joint planning by adults and students. But research literature reveals that program planning at the local level in many societies is still devoid of some essential ingredients--variables such as manpower demands, students' needs,

teacher availability, financial resource considerations, educational philosophy and policies and facilities and equipment availability.

It is critical that Nigeria begin looking far into the future, in recognition of the fact that technology which affects the individual, society and education is never static but dynamic. Technology has an overriding influence on curriculum and occupations. Henry (1982) stressed the need for individuals and society to keep abreast of technological innovations when he wrote:

> In a society characterized by an ever-increasing rate of change, industry and technology are two of the areas that most show manifestations of that change. In the past decades, industry has seen mechanization, automation, and finally computerized automation. Each generation of improvements--the incorporation of machines, the use of controlled automatic machines has contributed to the changing environment for the worker. With each generation, the worker has had to master new tasks (Henry, 1982, p. 15).

Emphasis on science and technology should achieve for Nigeria progress in agriculture, health, industrial and mineral resources development. Perhaps, this is why Nigeria's top priority is to develop her human resources through science and technological education in recognition that the wealth, prosperity and vitality of any nation rests on the development of its human resources and upon the effective commitment of human energies and talents.

The scarcity of sufficient trained human resources has been a major constraint on the rates of economic development.

This means that Nigeria must devote substantial resources to education and the development of skills in order to keep pace with advanced countries of the world. Clark (1971) very much concerned about bridging the gap between Nigeria and the advanced countries had this to say:

> In this space age, with science and technology performing spectacular feats in the industrial, engineering, medical and other fields, the importance of these disciplines cannot be over-emphasized. We are all witnesses of the role played by them in the technological ascendancy of the developed countries of the world, particularly in the United States of America and the Soviet Union. If Nigeria is to develop its vast human and material resources and keep pace with the advanced countries of the world, we too must develop scientifically and technologically (Clark, 1971, p. 10-11).

It is generally accepted that the road to any nation's economic development lies predominantly in the diversification of its economy in which industrialization has an important part to play. Nigeria, like any other country of the world, has embarked on a policy of industrialization. This was evidenced in her 1962-68 Development Plan in which industry was one of the top priorities and in the Fourth Development Plan in which the dispersal of industries is the primary objective of government. Unfortunately, the rate of industrialization in Nigeria has progressed slowly owing to lack of necessary "know-how" and capital.

According to Onyemelukwe (1966), the problems of technical "know-how" and capital are ultimately linked since one without the other cannot give the type of lift to the economy

which developing countries need. He argues that the fundamental benefits of industrialization will not come to Nigeria until her people are able to do the work themselves (p. 22). Unfortunately, manual skills and technical knowledge are not held in high esteem in Nigeria. To this problem, the Ashby Report offered the following solution:

> We strongly believe that the most effective way of correcting this would be to introduce a manual subject as an obligatory ingredient of all primary and secondary schooling; not as a vocational training, but because such subjects have educational value which entitles them to a place in general education. We will likely moreover to see technical streams in some secondary schools leading to a school certificate examination which includes technical subjects (Onyemelukwe, 1966, p. 288).

Referring to the problem of training young Nigerians in manual and technical skills, Onyemelukwe (1966) further suggested:

> The basic solution is that the social incentives must be geared to attract manual skills and technical "know-how".... If an increase in technically trained personnel is to be achieved, the country must be prepared to offer them status as well as employment. Any arrangement by which technical experts and professionals are placed under administrative officers betrays a bias against technical "know-how" (p. 290).

It is important to note that what we need in Nigeria as a matter of urgency is a national policy on industrial technology, a policy directed towards structural and qualitative improvement of technical and vocational education, a policy that fosters research related to technical and vocational education with emphasis on curriculum development, teaching

and learning methods and materials and on technologies and techniques related to development problems.

Our educational institutions should aim to prepare the Nigerian youth for work, so that upon graduation they will be able to create and provide jobs for themselves and others.

Problem of the Study

Court (1978) points out that one major factor contributing to the constantly high youth unemployment rate is the failure of many employment and training programs to develop marketable job skills. According to Woodhall and Ward (1972), educated manpower is obviously an important element in economic development. The economy and its rate of growth are dependent on an adequate supply of skilled and trained manpower. The general acceptance of this view forms the basis for curriculum planning based on manpower demands and needs and interests of the students.

This study was designed to investigate the curriculum approaches, occupational emphasis, and program evaluation components of industrial technology programs within the Nigerian Federal Universities of Technology.

Purpose of the Study

This study was conducted for the purpose of developing a model plan for use by the educational administrators and

planners in upgrading and restructuring the existing industrial technology programs in the Federal Universities of Technology in Nigeria. The study was structured to include the following considerations:

1. Curriculum approaches to be adopted,
2. Programs to be emphasized,
3. Evaluative practices, processes and guidelines to be utilized in the industrial technology programs.

Need for the Study

Most writers refer to planning as a definition of goals or objectives. Drior (1975) precisely defined planning in general as a process of preparing a set of decisions for action in the future, directed towards achieving goals for optimal means.

The rationale behind planning in educational institutions is that every institution should know where it is going. Educational administrators and planners should therefore be engaged in program planning to give direction to their programs and institutions.

There is an urgent need for program planning in industrial technology in Nigeria. This need has been increasing at a rapid rate due to population growth, expansion of the economy, unemployment, underemployment and technology explosion. Our resources are limited and, consequently, priorities

must be determined in order to allocate the scarce resources to the numerous competing alternatives.

Planning has a long tradition in Nigeria. For instance, the first ten-year development plan which involved over 110 million dollars (₦70) was adopted in 1946. The plan was revised several times during the plan period. Another development plan started in 1955 and since then planning became a regional as well as a federal matter. Consequently, a National Economic Council was inaugurated to coordinate federal and regional activities.

Stokke (1970) reported that out of the total outlay of $1,353 million under the 1962-1968 development plan, 13.6% was allocated to primary education, 13.4% to trade and industry and more than 4% to other sectors such as transportation, communications, irrigations and power supply for industrial purposes.

Ever since the 1962-1968 Development Plan period, the federal government has been increasing the education budget, especially in the technical field. This measure was taken in recognition of the fact that technical education forms the basis of Nigeria's technological development. In her National Policy on Education, Nigeria made the following declaration:

> A greater proportion of educational expenditure will continue to be devoted to technical education by government at both federal and state levels (Federal Republic of Nigeria, 1977, p. 20).

Under the Fourth National Development Plan, the state governments allocated a total of $1104.9 million out of which $596.2 million will be spent on the expansion of existing technical colleges and construction of new ones (Federal Ministry of National Planning, 1981).

Educational planners at all levels should aim at justifying the huge governmental expenditure on education by planning educational programs which are responsive to the needs of the country. In order to conduct realistic planning in vocational education, the General Conference of the United Nations Educational, Scientific and Cultural Organization (UNESCO) recommended that developing countries should:

1. Place high priority on technical and vocational education in national development plans as well as in plans for educational reform,

2. Base their planning on thorough evaluation of both short-term and long-term needs taking into consideration any variation in needs which may exist within a country,

3. Make adequate provision for proper current and future allocation of financial resources as a major element of planning,

4. Ensure that planning is done by a responsible body or bodies having authority on the national level. This body should have available to it data which have been collated, analyzed, synthesized and interpreted by qualified staff provided with adequate research facilities (UNESCO, 1979, p. 118).

Unfortunately, our educational system has not been able to generate sufficient skilled manpower for our rapidly expanding industries. Damachi (1973) reported that the most

important problem in Nigeria is the shortage of critical skills. He emphasized:

> In the senior category, there is a short supply of engineers, scientists, doctors, veterinarians, and agronomists. At the intermediate level, there are even more severe shortages of nearly all technical, sub-professional, and certified teaching personnel. In addition, there is a considerable shortage of senior craftsmen and technical foremen as well as high level secretarial and clerical personnel (Damachi, 1973, p. 82).

The Nigerian National Universities Commission, 1963, while expressing the need to utilize the indigenous skilled labor in the Nigerian industries stated:

> Industries require not just a few highly competent expatriate advisers but a very large number of highly educated Nigerian men and women. However, institutions of higher learning and industries in Nigeria are realizing more and more that it is just not enough to move continuously along the trail we have hitherto blazed, but that new techniques will be required to solve the problems which now stare us in the face (Uwagboe, 1971, p. 35).

Unless appropriate steps are taken, it may be very difficult for the Nigerian institutions to produce skilled personnel in sufficient quantity for our government, civil service, and industry at its present rate of expansion. It may not happen in the near future. The Nigerian universities, for example, have been accused of turning out graduates in large numbers mostly in the liberal and nontechnical fields. There is limited opportunity for these graduates to be gainfully employed in our manufacturing industries.

Onyemelukwe (1966) blamed the shortage of skilled man-

power in Nigeria on the universities and technical colleges adding:

> Technical courses in universities and technical colleges were often too rigidly tied to the requirements of a foreign examination, syllabus, and sometimes the programs are copied from foreign countries (p. 286).

He expressed further:

> Literary tradition and university degree have become indelible symbols of prestige in Nigeria, by contrast technology, agriculture and other practical subjects particularly at the sub-professional level have not won esteem.... Further-more the Nigerian public does not have respect for manual skills and technical knowledge (Onyemelukwe, 1966, p. 287).

The fact that Nigeria lacks sufficient manpower needed for industrial development was also recognized in the 1962-1968 National Development Plan which stated:

> There is a considerable deficiency at present of high and intermediate level manpower. This represents the greatest impediment to rapid industrial growth. Today, the inflow of skilled manpower is even more urgently required than the flow of capital (Onyemelukwe, 1966, p. 34).

Another important factor that has contributed immensely to a lack of skilled manpower in Nigeria is that educational planners have not given serious considerations to employment prospects. To support this assertion, the assistant registrar of student affairs in the University of Lagos, Mrs. Oluremi Oyewole attributed the unemployment problem in Nigeria to lack of planning and foresight on the part of our policy makers. She argued that more universities are being established without commensurate employment opportunities (Daily

Times, Oct. 17, 1982, p. 17). Mrs. Oyewole added:

> For obvious reason, the most hard hit are graduates of single subjects in Arts and Science disciplines generally referred to as non-professional. The number is teeming because Joint Admissions and Matriculation Board (JAMB) pegs the quota for professional courses intake into the universities (p. 17).

Table 1 shows that the Nigerian universities produce more graduates in arts and humanities, education, social sciences, natural sciences and medicine. Enrollment practices in the universities do not take into account the employment opportunities in the job market.

Doubtless enough, estimates of future occupational demand provide important information needed for the evaluation of employment prospects. Each year, millions of Nigerians enroll in educational and training programs with the hope that they will lead to successful occupations. At the same time, thousands of job openings occur probably due to business expansion, deaths or retirements. Most of the time, the number of job openings in an occupation does not match the number of people trained for that occupation. In some occupations, the number of qualified applicants exceeds the number of job openings, while in others, a shortage of personnel occurs. It is this situation that the United States Department of Labor Statistics refers to as an "imbalance" in the labor force. It states:

> Such imbalances are costly to both the individual and the nation. Eliminating such imbalances may be impos-

Table 1. Enrollment trend for all Nigerian universities[a]

Field of study	Year				
	1975/76	1976/77	1977/78	1978/79	1979/80
Arts and humanities	5,132	6,485	6,938	5.968	8.731
Agriculture	1,625	1,990	2,321	1,959	2,497
Administration	1,703	2,112	1,845	3,368	2,593
Education	5,126	7,025	6,239	6,298	9,487
Engineering	2,426	2,768	3,381	2,554	3,981
Environmental studies	826	962	993	1,325	1,786
Law	1,574	1,906	1,045	2,322	2,565
Medicine	4,045	4,469	6,123	5.847	7,354
Natural sciences	5,000	6,101	6,338	6,491	7,453
Social sciences	3,595	4,539	4,877	7,376	8,343
Veterinary medicine	459	520	515	618	459
All disciplines	31,511	38,877	41,417	45,201	57,772

[a]Source: Federal Ministry of National Planning (1981). (See Appendix I for areas of manpower shortages in Nigeria.)

> sible, especially in an economy where individuals are encouraged to make their own educational or career choices. The use of occupational demand and supply information in career guidance and educational planning can limit the difficulties (U.S. Department of Labor Statistics, 1980, p. 1).

In support of the above, Ogunbajo (Daily Times, Oct. 17, 1982, p. 17), an employer of labor in Nigeria, attributes graduate unemployment in that country to the students' lack of exposure to career choice. He suggested that guidance and counseling units should be set up to assist undergraduates to choose careers relevant to the needs of the labor market.

The National (U.S.A.) Commission on Employment and Unemployment (NCEU) emphasized the need for data base on employment conditions and job prospects. In its recent report, it stated:

> Data on employment conditions and job prospects by occupation are crucial for wise investment of the millions of dollars spent each year on specialized occupational, education training programs by federal, state and local governments, by employers and by trainees or their families (U.S. Dept. of Labor, 1979, p. 106).

Nigeria must have a reliable method of forecasting her manpower needs and demands. According to the United States Department of Labor Statistics (1980), to get the complete picture of future occupational demand estimates, individuals must know not only how many jobs are available, but also how many people will seek those jobs. It suggests that for each occupation, supply estimates should include the following:

1. The number of persons completing training specially designed to prepare them for work in that occupation,
2. The number of persons completing related training,
3. The proportion completing training who will seek jobs in that occupation,
4. The number of persons currently not in the labor force who are qualified and who will seek jobs,
5. The number of immigrants who are qualified, and
6. The effect that changes in relative wages may have on each of the above categories.

Education and training officials in Nigeria should utilize occupational supply and demand information in planning and evaluating educational programs. The federal government of Nigeria should specify in legislation that government training programs and vocational education should be planned on the basis of information on employment prospects and long-range projections.

It is important to note that technological advancement affects different occupations and consequently our curriculum content. As a result of this, many vocational educators expressed the need for future workers to be trained in occupational clusters, given more general conceptual knowledge of industry and technology, and given opportunities and training to develop adaptability rather than be trained in specific occupations (Davis, 1976; Hammond, 1976). Adaptability will be necessary because single occupations will be short-lived (Broudy, 1972). Henry (1982) subscribed to training in

occupational clusters because, according to him, the person trained for one single occupation in school is the person who will likely have to be retrained.

The General Conference of the UNESCO at its 18th session in Paris (UNESCO, 1979) recommended that technical and vocational education as preparation for an occupational field should provide the foundation for productive and satisfying careers. According to UNESCO, developing countries should provide vocational and technical education that will:

1. Lead to the acquisition of broad knowledge and basic skills applicable to a number of occupations within a given field so that the individual is not limited by his education in his freedom of occupational choice, and later transfer from one field to another in the course of working life is facilitated,
2. Offer a thorough and specialized preparation for initial employment and effective training within employment,
3. Provide the background in terms of skills, knowledge and attitudes, for continuing education at any point in the individual's working life (UNESCO, 1979, p. 112).

Time has come when Nigeria should get the community involved in developing and implementing educational programs for the training of skilled workers needed in our fast-growing industries. Carey (1964) recognized the need for participative educational planning when he wrote:

> Each community has a direct stake in solving its share of today's educational crisis. New industry will not come to an area that lacks skilled manpower and education resources to answer a continuing supply of manpower. Existing industry may not even gamble on expansion in such a town. When such a situation develops,

> the more ambitious worker may leave for better opportunities and community starts to decay (Carey, 1964, p. 5).

Harbinson (1965) stated that the wealth of a country is based upon its power to develop and to effectively utilize the innate capacities of its people. He went further to say that the economic development of a nation is ultimately the result of human effort. According to Uwagboe (1971), Nigeria possesses a diversified industrial structure in which considerable capacity is unutilized presumably owing to shortage of supplies of trained technicians. He stated that the education of employees within any modern industry should be of primary concern of management.

The Federal Government of Nigeria has observed that, in the last few years, very little or no capital projects were implemented in the older universities and argued that "this did not augur well for the growth of the universities, especially in the areas concerned with the academic programs and research" (Federal Ministry of National Planning, 1981, p. 260). In order to augment the nation's conventional universities in the production of high-level manpower, seven new Universities of Technology were established. These universities, in collaboration with the existing 24 Colleges of Technology and Polytechnics in the country, should aim at providing instructions over a broad spectrum of agriculture, engineering, and industrial technology. Through well-planned

programs of instruction, research and development and consultative services, these institutions will be better able to serve particularly the states and communities in which they are located and the nation at large. This objective can be achieved through the provision of undergraduate and graduate level study in industrial technology for a wide variety of professional fields.

Questions of the Study

The following questions formed the basis for this study:

1. What curriculum approaches should be emphasized in the Federal Universities of Technology for industrial technology programs to contribute to students' adjustment to technological changes in Nigeria?
2. What occupational areas should be emphasized in industrial technology program planning in response to national manpower demands, students' needs and the requirements of industry?
3. How should the programs and or curriculum be evaluated?

Assumptions of the Study

The following assumptions were made in the pursuit of the study:

1. The respondents were honest in their response to the

questionnaire.

2. The information sought in the study could not be obtained from any better source.
3. The sample selected for the study was large enough to be representative of the population.
4. The method of analysis of data collected was appropriate to the study.

Limitations of the Study

The following limitations were inherent in the study:

1. The study was limited to programs in industrial technology in the Federal Universities of Technology in Nigeria.
2. It was limited to the 19 states of the Federal Republic of Nigeria.
3. The findings of this study could only be generalized to the 19 states of Nigeria.
4. Finally, this study was limited to the extent to which the respondents provided honest answers to the items in the questionnaire and interview.

Procedure of the Study

The procedure for this study was as follows:

1. Review of literature and the Nigerian National Development Plans.

2. Ascertain the number of Federal Universities of Technology and their locations in Nigeria.
3. Write letters to the Federal Ministry of Education, Lagos, Nigeria for research funds.
4. Prepare a questionnaire and interview schedule to be used in the study.
5. Review the proposal and the questionnaire with the five members of the graduate committee.
6. Revise the questionnaire items.
7. Pilot-test the questionnaire with the Nigerian graduate students at Iowa State University.
8. Produce the final draft of the questionnaire.
9. Administer the questionnaire to the selected respondents.
10. Code the data on IBM cards and analyze the data using the computer facilities at Iowa State University.
11. Write the report.
12. Prepare a summary of the findings and make copies of the study available to the industries and state Ministries of Education in Nigeria.

Definition of Terms

The following terms are defined to clarify their use in context of the study:

Craftman or artisan: One who actually manufactures, maintains, and repairs an engineering structure or system.

Curriculum: A series of courses designed to cover the instruction in a designated field. It may refer also to the whole body of courses offered in an educational institution.

Engineer: Refers to one who by means of theoretical designs and formulas plans and designs an engineering structure or system.

Industry: The section of the societal economic institution that uses resources to produce goods and services and information to meet the needs and wants of individuals and society. The emphasis is on the human element--human endeavors (Hales and Synder, 1982).

Industrial arts: As a curriculum area is defined as those phases of general education which deal with technology, its evolution, utilization, and its significance and with industry, its organization, materials, occupation, processes, products and with the problems and benefits resulting from the technological and industrial nature of society (Maley, 1982, p. 5).

Industrial education: All educational activities that are concerned with modern industry and crafts, their raw

materials, products, machines, personnel and problems. It includes both industrial arts and vocational industrial education (Friese and Williams, 1966, p. 7).

Industrial technology: Refers to a management-oriented technical curriculum built upon a balanced program of studies drawn from a variety of disciplines related to industry. Included are sound knowledge and understanding of materials and production processes, principles of distribution, and concepts of industrial management and human relations; experiences in communication skills, humanities, and social sciences; and in proficiency level in the physical sciences, mathematics, design, and technical skills to permit the graduate to capably resolve technical-managerial and production programs (Anderson, 1983, p. 21).

Technologist: Is considered as the knowledge and study of human endeavors in creating and using tools, techniques, resources and systems to manage man-made and natural environment to extend human potential and relationship of these to individuals, society and civilization process (Hales and Synder, 1982).

Technical education: In the Nigerian context, it is defined as that aspect of education which leads to the acquisition of practical and applied skills as well as basic scientific knowledge. It is essentially vocational education intended to provide skills and manpower for industrial and

other engineering services required by the society (Folayan and Abdulkadir, 1981, p. 29).

Vocational education: Organized educational programs which are directly related to the preparation of individuals with employability and job specific skills required for paid and unpaid employment; said skills development being provided for educational programs where the requirements of a baccalaureate degree are not necessary for initial employment and for further specialized training. This means instruction related to the occupation(s) for which the students are preparing, or instruction for students to benefit from such preparation, and the acquisition, maintenance and repair of instructional supplies, teaching aids and equipment (Iowa Department of Public Instruction, 1980, p. 1).

CHAPTER II. LITERATURE REVIEW

Historical Background of Nigeria

Before the British annexation of the territory, Nigeria, which took its name from the River Niger, was not one country as it is today. It used to be a combination of various states, empires and territories with the Fulani Empire of the North being the most influencial. Following the British amalgamation of the North and the South, Nigeria came into existence as one united country in 1914. Ever since, the British colonial administration ruled the country as one political entity for a period of 46 years.

Without bloodshed, Nigeria won its independence in 1960 as a Federation comprised of three regions, namely, the Eastern, the Western, and the Northern, with Lagos as the federal capital. In 1963, the year the country became a republic, the Mid-Western region was carved out of the Western region.

The country enjoyed civilian rule until 1966, when the military overthrew the civilian government in a bloody coup. The military ruled Nigeria from 1966 until 1979 when the civilian administration took over control of the government. The military government, while in power, divided the country into 12 states in 1967, and later, 7 more states were added. The creation of still more states is underway.

Geographical Location

Nigeria lies approximately between longitude 3° and 15° East of Greenwich and between latitude 4° to 14° North of the Equator. The country is surrounded by French-speaking West African countries except in the south where it is bordered by the Atlantic Ocean. The Republic of Benin lies to the west, Niger Republic to the north, and Cameroon to the east.

Size: The greatest distance from the east to the west of Nigeria is approximately 1,120 kilometers and from north to south, 1,040 kilometers. The total area covers about 925,000 square kilometers which is approximately the size of Texas and Oklahoma combined, about three and one-half times the size of the United Kingdom, nearly four times the size of Ghana and thirteen times the size of Sierra Leone. Nigeria occupies about 1/7 of the total mainland area of West Africa.

Population: Nigeria is probably the leading Black African nation with a population of about 80 million citizens. The country is regarded as the most populous country in Africa. About the Nigerian population, Iloeje (1973) wrote:

> Her population is greater than that of all the other West African countries put together, seven times that of Ghana, three times that of the Republic of South Africa, and third only to India and Pakistan in the British Commonwealth (p. 17).

Nigeria has about 250 different ethnic groups with different dialects as well as varying traditions, history and culture. The predominant tribal groups include the Hausas,

the Ibos, the Yorubas and the Fulanis. The Hausa tribe comprises 21% of the population, the Ibos 17%, the Fulanis 10%, and the Yorubas about 14%. About 47% of the Nigerian population are Moslems, 35% are Christians while the remaining 18% have various traditional beliefs.

Although different ethnic groups speak different tongues, English is the official language and the medium of instruction in educational institutions.

Economy and Natural Resources

Agriculture is the mainstay of the economy with over 70% of the total working population engaged in agricultural activities. Agriculture, however, is on a subsistence level and food production has not kept pace with the demand by the ever-growing population. A considerable measure of food consumed in Nigeria is imported from overseas. However, Nigeria is embarking on a "Green Revolution" which is an effort to solve the nation's food shortage. Stokke (1970) summarized the Nigerian economy when he stated:

> Nigeria has a fairly diversified economy. As is the case in most developing countries, agriculture constitutes the most important sector. Nigerian agriculture is, however, diversified. Natural resources including forests and minerals constitutes another important sector. The rich oil deposits may be the basis of a structural change in the economy and provide promising prospects for the future. A growing and diversified manufacturing industry is also an important part of the picture (p. 28).

Nigeria is currently the world's sixth largest exporter of crude oil, producing about two million barrels daily and earning approximately 25 billion dollars in 1980 (Nigerian Universities Commission, 1982, p. 21). According to Ludwig (1973), the returns from petroleum exports were already sufficient to ease Nigeria's balance of payment problems in the past.

Industrialization in Nigeria

For a developing country the size and potential of Nigeria, industrialization is essential for rapid economic and social transformation. Dispersal of industries is a primary objective of government (Federal Ministry of National Planning, 1981, p. 136).

The structure of manufacturing industry

Structurally, the manufacturing industry is comprised of a few industrial groups of beverages, textiles, tobacco, petroleum and coal products. About 90% of total output is consumer goods. Capital or intermediate goods are hardly produced in Nigeria.

The manufacturing industries can be subdivided into local crafts industries in which local craftsmen manufacture articles in relatively small quantities in small workshops and factory industries where goods are mass produced by factory workers.

Local craft industries The local craft industries are found all over the Federation. Such industries include brass and silver works, leather work, rope and mat making, wood carving, textiles, and pottery and glass. These local industries depend on locally available raw materials and appropriate technology. Although the workmen use simple tools, they produce works of high artistic quality which are locally consumed (Iloeje, 1973).

Leatherwork: The center of this industry is Kano, capital of Kano State. Using locally produced leather, dyestuffs and imported chemicals, these industries produce high quality sandals, cushions, saddles, scabbards and handbags.

Metalwork: Kano, Bida, and Benin City are particularly important for brass and silver work, thus producing brass trays, flower vases, ornaments and figures.

Fiber industries: Akwette, Oyo, and Kano are noted for cotton weaving and dyeing. The craftsmen of this industry use imported threads to produce fine and highly colorful designs.

Wood work: The people of Awka in Anambra State, Ikot Ekpene in the Cross River State, and Benin in Bendel State are particularly famous for their wood products. The craftsmen produce household furniture and carve traditional objects such as masks, stools and statues. Figure 1 shows the subsistence craft industries in Nigeria.

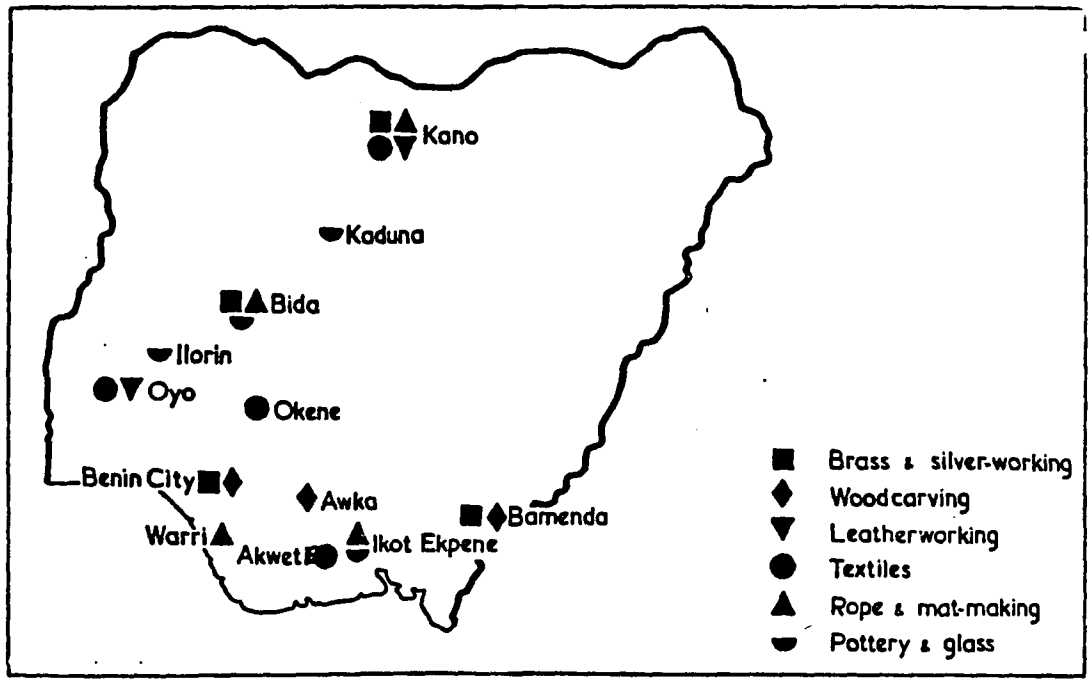

Figure 1. Subsistence craft industries in Nigeria

Factory industries Factory industries are located in four main zones and three principal outlying areas as follows:

1. The Western Industrial axis: This includes Lagos, Ibadan, Abeakuta, Epe, Agege, Ilorin and Ewekoro.
2. The Southeast Industrial zone: Nkalagu, Onitsha, Port Harcourt, Oji River, Enugu, Aba, Umuahia, and Calabar are included in this zone.
3. The Northcentral Industrial zone: Comprised of Kano, Kaduna, Jos, Zaria, Makeri, and Kurra.
4. The Midwestern Industrial zone: Includes three major towns, namely Benin, Sapele and Warri.
5. The three principal outlying areas include Kainji, Markudi and Sokoto.

The areas mentioned above contain the most important industrial towns where approximately 90% of the Nigerian factories are located. About 75% of the industrial activity is concentrated in the cities of Lagos, Kaduna, and Kano; Port Harcourt was a prominent industrial location before the civil war (Ludwig, 1973, p. 168). Lagos, by 1969, accounted for half of the country's industrial activity. It is worth mentioning that, in the industrial towns, only a small percentage of the population is engaged in industrial production.

Some of the prominent factory industries in Nigeria include:

1. Textile industries: These are concentrated in Lagos

Kaduna, Aba and Onitsha. They produce high quality baft drill and shirting materials.

2. Cement factories: Nkalagu, Ewekoro, Port Harcourt Calabar, Sokoto, Ukpilla, Markudi, and Ashaka are noted for cement production.

The demand for cement in Nigeria has increased considerably over the past two years. Like beer, cement is one product that is in high demand in all seasons. It is used extensively in building houses, roads, and structures such as bridges, walls, culverts, gutters, paving slabs, etc. A small house in Nigeria may require as many as 300 bags and a fairly large house may require up to 1,000 bags (Egbochukwu, 1983). The Cement Manufacturing Association (CEMAN) estimated the total demand for cement in 1983 at 8 million metric tons notwithstanding the poor state of the economy. Table 2 shows the estimated local cement production in 1983. The difference between the supply and the demand has been estimated at 4.5 million metric tons (90 million bags) which will be imported from Europe. According to Egbochukwu, the reason for the low productivity was probably related to the variability of power supply and the austerity measures imposed by the federal government. Also, the Nkalagu cement factory closed down by the Anambra State government has been another drawback of the industry.

Table 2. Estimated local cement production in Nigeria (1983)[a]

Factory	Metric tons
Shagamu	900,000
Ewekoro	700,000
Ashaka	700,000
Ukpilla	450,000
Sokoto	80,000
Benne (Markurdi)	850,000
Calabar	40,000
Nkalagu	-
Total	3,720,000

[a]Source: Egbochukwu (1983).

3. Breweries: Beer production and distribution is the largest industry in Nigeria and scattered all over the country. Beer factories are found in almost every major city in the country.

4. Chemical industries: Iloeje (1973) reported that the soap factories at Aba, Apapa, and Kano together manufacture over 25,000 tons of soap every year. Lagos and Port Harcourt are known for the production of industrial gases, while Kano and Lagos remain the centers for cosmetics. Drugs are manufactured in Lagos and Aba.

5. Metal goods industries: Owing to the ever-increasing need for construction materials, many factories have been established in Nigeria. The first steel industry was established at Emene in Enugu. Other steel plants include the Ajaokuta Steel Company Ltd. and the Aladja Steel Complex (Delta Steel).

According to the Anosode Report (Federal Republic of Nigeria, 1981), the importance of the national steel industry and its vital role in the industrial potential of this great country had been recognized by the Federal Government since the last sixties when government invited experts from the Soviet Union to carry out massive explorations, metallurgical tests and research throughout the country. In the Third National Development Plan (1975-1980) (Federal Ministry of National Planning, 1975), substantial provisions were made for the implementation of a conventional integrated blast furnace steel plant at Ajaokuta, Kwara State, and a direct reduction steel plant at Aladja in Bendel State. In addition, three steel rolling mills located at Jos, Katsina, and Oshogbo are now physically under construction and are scheduled to be commissioned in 1987. The report also stated that the projects under the National Steel Development Program were being executed by the Steel Development Department, headed by a cabinet minister and located in the executive office of the President with the following parastatals:

a. The Ajaokuta Steel Company Ltd.

b. The Delta Steel Company Ltd. (Aladja)

c. The Jos Steel Rolling Mill

d. The Katsina Steel Rolling Mill

e. The Oshogbo Steel Rolling Mill

f. A National Steel Council (made up of the exploration and metallurgical Test and Research Division)

g. Metallurgically Training Institute (Onitsha).

Industries, iron and steel, have received the largest slice of President Shagari's cake "reflecting the need for industrial development and the laying of a foundation for technological growth (Industries, Iron and Steel in Nigeria, West Africa, Jan. 1982, p. 186).

A significant event took place on January 29, 1982 when President Shehu Shagari pressed the botton to commence production at the Delta Steel Plant at Ovwian-Aladja in Bendel State. At that moment, Nigeria joined the steel-producing nations and passed a major milestone in its efforts to achieve true industrial and technological independence. Speaking at the opening ceremony, Shagari said:

> My administration is convinced that the greatest gain Nigeria will derive from this project is the rapid development of skilled and technological capabilities without which we cannot achieve national self-reliance. I'm looking forward to the day when Nigerians will be designing and constructing steel plants and other industrial projects (West Africa, 1982, p. 2639).

About the Aladja steel plant, Barrett (1982), writing

in the West Africa Magazine of January 1982, had this to say:

> The commissioning of the steel plant at Aladja marked both the culmination of a dream and the beginning of a new phase of development in Africa's thrust towards self-sufficiency (p. 82).

The Ajaokuta steel complex will go into full production in 1983, and it is expected that the first stage of the steel complex will roll out steel by June 1983.

The projected demand for steel products and basic flat steel for industrial conversion in Nigeria by 1990 is expected to be about 9 million tons. Even with full production and the completion of Ajaokuta Blast Furnace Mill and three rolling mills at Oshogbo, Jos, and Katsina, Nigeria will not be in the position to fulfill all its steel needs by 1990 from domestic sources. Aladja will produce one million tons in its first phase and 2.5 million tons at peak production. The rolling mills will produce initially 210,000 tons of steel products annually. Production will be stepped up eventually to 720,000 tons per annum (Steel Production in Nigeria, West Africa, Oct. 1982, p. 2639).

The first stage of the Ajaokuta complex will produce 1.3 million tons of steel which will be increased to 2.6 million tons in the second stage by December of 1982 and 5.0 million tons in the future (Odubona, 1982, p. 3).

The two steel plants, unfortunately, are facing some difficult times. The Ajaokuta mill is experiencing some financial problems as a result of the austerity measures imposed

by the federal government. It also has problems with power supply, supply of iron ore, natural gas supply, dredging of the River Niger and transportation.

The Aladja plant, a year after its commissioning, has been encountering setbacks due to the lack of production materials. The company has been experiencing difficulties in getting raw materials and spare parts. The shortage of production materials has resulted in a drastic reduction in production (Buoro, 1983, p. 9).

Iron ore to support the steel plants has been discovered in Nigeria in such places as Udi, Enugu, and Agbaja. An agreement was signed between the Nigerian government and the Soviet Union in 1970 to reemphasize the active participation of Nigerian personnel in geological surveys to cover all potential raw materials sources for iron and steel manufacture. As a result of this effort, Itakpe iron ore deposits were discovered in Kwara State.

The Daily Times of August 24, 1982, reported that a steel mill project was to be set up in Lagos State to keep the city clean through the collection of metal junk for its commercial purposes. According to the report, the selection of industrial areas had already been laid out in Badagri, Epe, and Ikorodu for proper industrial take off (Daily Times, 1982, p. 23). This project was in line with the government's policy of the dispersal of industries as its primary objective,

within the limits imposed by economic feasibility study (Federal Ministry of National Planning, 1981, p. 145).

6. Engineering works: Two manufacturers of cars are assembling their cars in Nigeria presently. Both Volkswagen and Peugeot started assembly plants in 1974 and, in 1975, Leyland went into partnership with the Nigerian government to produce trucks. Presently, the three groups are producing vehicles for the home market. It is hoped that in the future these companies will produce for export.

7. Other industries: Other industries include agro-based industries comprising pulp and paper industries and food processing industries, and mining industry.

(a) Mining industry: Apart from the oil industry, the federal government has plans to develop Nigeria's natural gas reserves and also to develop her nonpetrochemical industry for the country to meet her own chemical requirements, rather than exporting crude oil to be processed elsewhere.

The mining and quarrying industry has contributed immensely to Nigeria's GDP as a major source of government revenue and foreign exchange earnings. This sector played a leading role in the economic developmeng during the Third National Development Plan period with its share of GDP rising from 21.89% in 1975-76 to 25.22% in 1976-77 (Federal Ministry of National Planning, 1981, p. 127). The petroleum production has increased considerably over the years except for a slight

drop in 1978 due to a decline in demand for oil products in the world market. Table 3 reveals an increasing trend in the production of petroleum and a fluctuation in the production of tin, limestone, columbite, casserite, and coal for the 1975-1979 period. The year of peak production of coal in Nigeria was 1958-1959. At that time, however, coal was mined only at Enugu, with the production of 75,450 tons monthly amounting to 905,397 tons annually (Okafor, 1973, p. 7). At that time, coal occupied a leading place in Nigeria as the key source of power. The decline in coal production began with the introduction of new energy policies in the early 1960s resulting from extensive use of diesel and hydroelectric power plants.

Table 3. Mineral production in Nigeria, 1975-79[a]

Year	Petroleum (million barrels)	Tin metal	Limestone	Colum-bite	Casser-ite	Coal
			tons			
1975	651,315	4.265	309.643	991	6.285	248.791
1976	757.652	3.809	1,553.527	673	5.008	290.949
1977	765.297	3.315	1,243.198	862	4.402	237.509
1978	692.269	2.985	409.268	567	3.981	263.774
1979	840.864	2.188	2,064.070	521	3.374	166.024

[a]Source: Federal Ministry of National Planning (1981, p. 127).

Because the Nigerian coal has not been found suitable for producing coke for metal work, it is the intention of the Nigerian government to use a blend of the Nigerian coal with imported coal to operate the Ajaokuta blast furnaces. However, studies show that a maximum of 25 to 30% of the Nigerian coal can be used in such blends. Okafor (1983) stated:

> ...because of its deficiency, Nigerian coal is unlikely to become a useful export commodity in the near future. However, with its good thermal qualities and rich chemical content, it can meet escalating energy needs and even support domestic chemical industries (p. 7).

According to Okafor (1983), there are about 270 million tons of proven coal reserve in Nigeria and perhaps even larger quantities of unproven reserves. The largest reserves are thought to exist in Benue State, while the main body of coal is found within the Anambra River basin. It has also been reported that coal has been discovered in the Lafia-Obi area of the Plateau State and near Gombe in Bauchi State. Also, lignite or brown coal exists in a belt stretching from the lower Cross River to Onitsha, Ogwashiuku, Okitipupa and beyond.

It has been estimated that by 1985, Nigeria's coal mines should yield 2,575,000 tons of coal most of which will be consumed by large coal-fired power stations and by the Ajaokuta steel mills. The proposed Benue power station is also expected to burn 1,600,000 tons of coal every year, while Ajaokuta should consume a further 400,000 tons. The

remainder will be used by the Nkalagu cement factory and the Oji River power station, which is to be expanded to a capacity of 120 megawatts from its present 30 megawatts. Production of enough coal for the above projects requires not only new investments in mining technology but also large-scale expansion of the Enugu and Okaba mines (Okafor, 1983, p. 7).

The place of manufacturing industry in Nigeria's economic development

The manufacturing industry is regarded as a sector with a high growth rate in Nigeria. In support of this claim, Stokke (1970) stated:

> This sector ranked third in 1958, with 4.4% of the GDP and fourth in 1966, with 5.9% of the GDP. The average annual growth rate was 9.4% declining from 13.8% during the first period to 5.2% during the second (p. 71).

Although the sector has had a rapid growth in recent years, it still accounts for a small proportion of the gross domestic product. A record rise in output of 500% was recorded between 1950 and 1960 and again doubled from 1961 to 1963, but the actual value of production remained less impressive.

The actual value of production by the modern establishments was $5.8 million in 1950, $29.0 million in 1960, and $58.0 million in 1962. This increase has been maintained over the years. But there seems to be a declining trend in

the traditional sector as opposed to the modern sector. For instance, in 1958, the manufacturing sector grew from 2.6% to 4.6% in 1966, while the handicraft declined from 1.9% in the same year (1958) to 1.3% in 1966.

Ludwig (1973) attributed the expansive development of the manufacturing industry to the abundant natural resources of the country and the size of the economic market. He observed:

> The export processing of agricultural and mineral products and the import substitution of consumer goods determined growth in Nigeria. The process of industrialization, however, was actuated by the competition of foreign enterprises for the Nigerian market and accelerated by the industrial policy of government (p. 27).

The federal government supported this development in its Fourth National Development Plan with the following statement:

> Nigeria has the human and material resources, a relatively big market both in terms of population and money income, and an energetic private sector necessary to build a strong industrial base for the long term growth and development of the economy (Federal Ministry of National Planning, 1981, p. 136).

Between 1970 and 1974, the contribution of the manufacturing sector to the GDP was listed at an average of 4%. In 1976, this figure rose to 7% but declined slightly to about 6% thereafter. Today, all manufacturing constitutes about 7% of the GDP while engineering manufactures specifically contribute about 1% (Essien, 1983, p. 7). The $123 million (1981-1985) Development Plan expects manufacturing to grow by at least 15% per year. To achieve this objective, govern-

ment plans to channel the direct investment in industrial development to the creation of the basic industries that can provide inputs for manufacturers.

In spite of the low contribution of the manufacturing sector to the GDP, the sector has grown substantially for the past 20 years. For instance, in 1974/75, 77/78, it grew at an annual compound rate of 15.6% which was much higher than the 1970/71, 1972/73 figure of 11.5%.

The low contribution of the sector has been attributed to the low base from which the sector started since independence and partly because the colonial entrepreneurs did not encourage the growth of the manufacturing sector.

Until recently, the manufacturing sector has not played a remarkable role in employment. The number of workers employed in the manufacturing sector has not grown very rapidly primarily because of a lack of expansion of large industries. For instance, Stokke (1970) reported that more than 80% of the manufacturing establishments employed less than 100 persons and that the traditional manufacturing sector, though stagnant, employes a labor force estimated at half a million, mainly in small-scale producing units.

Despite the low employment potential of the manufacturing industry, one can see that the volume of manufacturing activity has increased at a very satisfactory rate, but suffice it to say that, if it is compared with some developing

countries, Nigeria is lagging behind. Table 4 shows that Nigeria's manufacturing sector exceeds the average of the six countries (Brazil, India, Mexico, Korea, Turkey and Nigeria) in just five industrial groups, namely, beverages, tobacco, textile, petroleum and coal products and the fabricated metal products. On the other hand, Nigeria fell short in the other 22 industrial groups. For the six countries, there seems to be a high concentration of value added (25-30%) with respect to food and textiles, but in Nigeria's case, beer, soft drinks and spirits contributed the highest increase (about 15.3%) to the total manufacturing value added.

Beverages made a low contribution (1.2-4.9%) to manufacturing value added in the other countries. It can be observed from the table that iron and steel basic industries made no contribution to the manufacturing value added in Nigeria prior to 1970, while it contributed 4.1% in Brazil, 5.7% in India, 3.8% in Mexico, 2.53% in Korea and 6.7% in Turkey. However, with the commissioning of the steel plants at Aladja and Ajaokuta and the steel rolling mills at Jos, Katsina, and Oshogbo, the picture is bound to change when the plants start production. The reason given for the sharp contrast between Nigeria and Brazil, India, Mexico, Korea and Turkey is that, while those countries have diversified into high technology industries, Nigeria still remains dominated by low technology industries (Federal Ministry of National Planning, 1981, p. 172).

Table 4. Comparison of contribution of some major industrial groups to manufacturing value added in Nigeria and 5 other countries (1970)[a]

Industries	Nigeria	Brazil	India	Mexico	Korea	Turkey	Average
Food manufacturing	11.73	13.32	8.31	18.24	14.13	15.94	13.61
Beverage	15.30	2.27	1.16	2.05	4.50	4.34	4.93
Tobacco	8.67	1.41	4.27	1.02	3.80	13.02	5.36
Textiles	14.79	9.14	21.77	9.94	15.70	13.92	14.21
Wearing apparel	0.51	1.68	3.79	8.09	6.70	2.32	3.85
Leather and products	0.51	0.63	1.63	1.43	0.33	0.40	0.82
Footwear	1.02	1.65	3.61	5.02	0.66	0.91	2.14
Wood except furniture	1.53	2.53	4.23	1.54	2.89	1.41	2.35
Furniture except metal	0.51	2.05	0.80	0.51	0.53	0.20	0.77
Paper & products	1.53	2.59	1.28	2.46	2.28	1.72	1.98
Printing & publishing	2.04	3.58	2.09	3.07	3.15	1.51	2.57
Chemical (industrial)	0.51	5.83	4.03	2.56	6.45	0.81	3.36
Other chemicals	0.51	4.87	4.68	5.22	3.82	3.83	3.82
Petroleum & coal products	8.16	2.01	0.10	0.20	1.09	0.20	1.96
Rubber products	1.53	1.94	1.41	1.33	1.58	1.82	1.60
Plastics	1.02	1.87	0.26	0.41	1.59	0.70	0.97
Pottery	0.51	1.39	0.45	0.10	0.45	0.91	0.63
Glass and products	0.51	0.94	0.85	1.64	0.77	0.80	0.92
Nonmetallic products (mineral)	2.04	3.61	4.09	3.28	4.38	3.33	3.45
Iron and steel	-	4.01	5.74	3.89	2.53	6.66	4.56
Nonferrous metal products	0.51	4.01	1.34	1.33	0.34	1.81	1.56
Fabricated metal	6.12	3.35	5.70	4.10	1.64	4.24	4.17
Machinery nonelectrical	0.51	7.35	4.08	3.07	1.93	2.62	3.26
Electrical products	0.51	5.34	3.33	4.81	4.17	1.82	3.33
Transport equipment	0.51	8.69	3.34	6.66	5.44	3.33	4.66
Prof. & scientific goods	0.51	0.95	2.55	0.41	0.34	0.10	0.81
Other manufacturing ind.	0.51	0.95	3.13	1.74	3.32	1.20	1.90

[a]Source: Federal Ministry of National Planning (1975, p. 21-23).

Apart from the domination of the Nigerian manufacturing sector by low technology industries, Nigeria has been over-dependent on petroleum, thus neglecting other sectors of the economy. If the country should achieve economic independence, it has to deemphasize oil and diversify into high technology industries. Nigeria must acquire high technology in order to compete with comparable industries in the world market.

The major inhibitor for cost-effective manufacturing is the lack of advanced technology. Essien (1983), writing in the Business Concord of February 11, 1983, stated that, in order to deemphasize oil in our economy, Nigeria must expand her manufacturing sector so that we can produce locally a good percentage of the goods we import into Nigeria. He emphasized:

> A strong manufacturing sector may do to our economy what it did to the economies of newly industrialized countries of the Far East. South Korea is one of those countries that have transformed their nations to industrialized status through manufactures of goods. Today manufacturing contributes 90% of the total exports of that country. Industrial production today contributes 30% of the South Korean GDP. Technological production also contributes 35% of the Taiwanese GDP (p. 7).

Leaders in the manufacturing sector recognize that advanced technology can contribute to the world economic recovery. Technology can improve production of goods and services in Nigeria too. Application of advanced technology by well-prepared workers can make Nigeria a self-reliant, self-sufficient, economically stable nation.

Industrialization and Economic Development

Industrialization has always been associated with an advanced economic status and, in developing countries, it has come to be regarded as the key to the development process (Teriba and Kayode, 1977).

The Nigerian government became interested in industrialization in 1957 in terms of industrial incentives and protection of the sector. The major policy objective of the Nigerian government during the 1970s was to develop industry rapidly as a means of promoting rapid economic growth. This spells a bright future for Nigeria in terms of economic development. In this respect, Stokke (1970) stated:

> The prospects for industrialization are more favorable in Nigeria than in most developing countries, partly as a result of wide range of raw materials available and partly as a result of the large domestic market (p. 89).

One important factor that necessitates industrialization in Nigeria is the imbalance in her rural economy. About 70% of the population is engaged in agricultural activity which accounts for at least 65% of the GDP. On the average, the agricultural sector has grown at about 4.5% per annum. Owing to this modest growth, Nigeria embarked on industrialization in order to achieve a satisfactory growth rate for the economy as a whole.

The target growth as stated in the Second National Development Plan of 1966 (Federal Ministry of National Planning,

1971) was 6% per annum for the entire economy. It therefore was estimated that, in order to achieve this objective, the industrial sector should grow at over 15% per annum. This calls for the expansion of the industrial sector as Asiodu (1967) insightfully advised:

> The need for the rapid expansion and diversification of the industrial sector of the economy is therefore obvious: to increase the incomes realized from manufacturing activity; push ahead with the program of import substitution in order to save foreign exchange and even earn some foreign exchange from the export of manufactured goods; and to create more employment opportunities (p. 161).

The major aim of the Nigerian Federal Government during the 1962-1968 National Development Plan was to mobilize Nigerian capital and to encourage a shift from commerce into processing and manufacturing industries. This move, no doubt, demonstrates the government's support for the establishment of modern industries to produce goods originally imported. The principal objectives of the new industrial policy as stated in the 1970-1974 plan include:

1. To promote even development and fair distribution of industries in all parts of the country;
2. To ensure a rapid expansion and diversification of the industrial sector of the economy;
3. To increase the incomes realized from manufacturing activity;
4. To create more employment opportunities;
5. To promote the establishment of industries which will cater to overseas markets in order to earn foreign exchange;

6. To continue the program of import substitution, as well as raise the level of intermediate and capital goods production;

7. To initiate schemes designed to promote indigenous manpower development in the industrial sector;

8. To raise the proportion of indigenous ownership of industrial investments.

It can be noted, therefore, that Nigeria's policy of industrialization is based on an inward-looking import substitution strategy of industrial development. This strategy involves an exclusive reliance on the domestic market as the source of demand for locally manufactured products. According to Oyejide (1971), this is made by the use of a system of industrial incentives which include high protective tariffs, tax subsidies, import licensing and exchange control. Asiodu (1967) contends that the greatest incentive and the most important stimulus to industrial development is the large size of the internal Nigerian market compared with that of other African countries and some developing countries elsewhere. He observed:

> The human resources are most impressive, and the demand for consumer goods are quite sophisticated. These factors provide the base for rapid and sustained industrial development (p. 229).

Leaders in Nigeria have recognized, as stated in the National Development Plans, that the key to future economic development lies with industrialization. It was no surprise then that the major objective of the Third National Development Plan was to establish a foundation for a strong indus-

trial base. Nigeria's initial concern was to supply her own industrial needs. With further expansion of the industrial sector, Nigeria aims at becoming a major industrial exporting country.

Despite government's efforts at industrialization, the manufacturing industry has experienced a slow rise from 5% to 8% of the total economy between 1960 and 1975. The Nigerian industry earns only about 2% of foreign exchange and half of the sector is comprised of light industry such as textiles and food products. The engineering sector is also very small.

It is interesting to note that there has been an increase in industrial output in the last two decades. The increase was accounted for largely by the new burst of activity in the petroleum industry. Production of crude oil in commercial quantity started in December 1957 and a high proportion of production is exported, the most important purchasers being West European countries, North America, Central and South American, and some African countries.

The petroleum industry is developing increasingly into a supreme driving force for economic growth in Nigeria (Ludwig, 1973). The industry has contributed immensely to the country's Gross Domestic Product apart from achieving other indirect growth promoting effects.

About the role of the petroleum industry in the economic development of Nigeria, Ludwig (1973) further stated:

> The direct and indirect contributions of petroleum industry to the national income will guarantee Nigeria, assuming relative political stability and an economic policy of investment on the part of government, continued economic growth during the rest of this century. Until gradual exhaustion of the petroleum reserves, Nigeria should succeed in considerably reducing the lead in development of the industrial nations and create the pre-requisites for an economic growth which is not dependent on petroleum. One means of realizing this aim, even if it is not sufficient on its own, is the industrial development of the country (p. 27).

Although the oil industry has contributed immensely to Nigeria's economic development, it has not succeeded in transforming the country into an industrial country. According to Teriba and Kayode (1977):

> In spite of the oil boom and the changing structure of the industrial output, it is true to say that the industrial base of the economy is still too low to make Nigeria more an industrialized country than a semi-industrialized one. And this low but advanced level of industrial development is to be explained more in terms of the strategies and policies adopted than in terms of sheer environmental problems (p. 6).

Writing on the Nigerian policy on industrial development, Teriba and Kayode (1977) went further to say:

> The policies and strategies of industrial development in Nigeria have not produced very satisfactory results. More specifically, the import substitution strategy and its methods of implementation seem to have resulted in an "enclave-type" development which leaves the industrial sector with a minimum of impact on the sectors of the economy, while the grip of foreigners on the economy still remains strong (p. 331).

Doubtless enough, all developing countries are very much concerned with the degree of foreign control of their economies. Nigeria is no exception. There has been a substantial measure of control of the Nigerian economy by foreign

investors. In addition to the import substitution strategy, Nigeria has adopted recently the indigenization policy in order to reduce foreign control to the minimum. This policy has not been very effective. Critics suggest that it was a superficial operation; that much foreign control remains and that a skillful foreign exploiter has little difficulty in coming into the country to exploit still more (Arnold, 1977). Babatunde (1975) did not see any positive effects of the indigenization program. He wrote:

> Despite the call for indigenization, foreign private investment remains the life line of the Nigerian manufacturing industries. About 70% of the paid up capital is foreign private while the remaining 30% is about equally divided between Nigerian private and public capital subscriptions (p. 21).

It seems that the failure of the indigenization program necessitated the need for Nigeria to embark upon a more realistic and ruthless policy of taking control of all foreign companies and assets. Arnold (1977) would like to see Nigeria adopt any other measure but indigenization. He stated:

> Since after independence, Nigeria had a long way to go before achieving national economic independence. The indigenization process has not been fruitful so far since it was started in the early 1970s. It has been described as a device whereby the Nigerian bourgeoisie protects imperialist economic domination in the country (p. 88).

Asiodu (1971) believes, however, that Nigeria has so far followed the classical and most practicable route to industrialization by starting with import substitution industries--textiles, beer, soft drinks etc., and that Nigeria has already

attained self-sufficiency in several of these items. He suggested that there is little scope for further import substitution in such consumer goods industries adding that the next step should be to produce more intermediate and capital goods for sale to other countries.

Some writers have blamed the government for contributing to the slow pace in industrial development. Lewis (1966) accused the federal government for failing to participate actively in industrial development. He stressed:

> Industry has developed in Nigeria without much active promotion on the part of the government. There has been a useful framework of tariff protection, industrial estates, pioneer tax exemptions, and industrial loans, but the governments have not always tried to get new industries in accordance with preconceived plans of what can or should be manufactured in Nigeria (p. 333).

Arnold (1977) again noted that:

> There can be no meaningful industrialization in Nigeria without the creation of a basic structure of industries that produce machines, tools, equipment, heavy machinery and chemicals. The manufacturing industry has remained remarkably small so far because industrialization has consisted of topping up and finishing products that substantially were made elsewhere (p. 82).

But Teriba and Kayode (1977) warned Nigeria's leaders against this type of industrialization (topping and finishing products) as they emphasized thus:

> The dominance of the industrial sector by mere assembly-type consumer goods means, of course, a high import bill for raw materials, intermediate and capital goods (p. 6).

It can rightly be inferred that Nigeria has to overcome many problems before it will be possible to achieve a con-

siderable degree of self-sufficiency through industrial development. Some of the problems are discussed below.

Problems of Industrial Development in Nigeria

The Ashby Commission reported the following:

> Nigeria is a nation of some fifty million people (now about eighty), with industries, oil, and a well developed agriculture, intimately associated with other free African countries on either side of its borders; a voice to be listened to in the Christian and the Moslem worlds; with its traditions in arts fostered, and with the beginning of its own literature; a nation which is taking its place in technological civilizations with its airways, its organ of mass communication, its research institutes (Ogunshe, 1971, p. 660).

About Nigeria's resources for development, Teriba and Kayode (1977) wrote:

> In associating the resources at a nation's disposal for industrial development, emphasis should be placed on the magnitude as well as the variety and quantity of such resources. Nigeria is rich in terms of these dimensions. She has the largest concentration of natural and human resources on the African continent, and provides, therefore, the most attractive single market (p. 12).

From the above statements, it can be noted that, of the three factors that constitute an appropriate environment for industrialization, namely resources, institutions and technology, Nigeria possesses the material resources in great quantity. But the quality of these resources is questionable. Other factors are limited and that is why Nigeria has not achieved a rapid economic development as Obafemi Awolowo observed in 1973:

> Although the nation has achieved rapid economic growth, it had gained little economic development (Arnold, 1977, p. 78).

One of the problems of industrialization in Nigeria is caused by an inadequate supply of the essential ingredients which lead to growth, manpower. Generally speaking, three levels of manpower have been identified as being important in any nation's labor force. These include high level, intermediate level, and lower level manpower. The intermediate level manpower group has been considered by most people as the most important single determinant of technological advancement in any nation. This group of workers constitutes the area of greatest manpower needed in both developing and developed nations. To support this claim, Ighedo (1979) quoted Dr. Worthington, the former associate commissioner for Adult Vocational and Technical Education, U.S. Office of Education, as saying:

> It is becoming increasingly clear that the largest increase in job opportunities in the nation's work force is now and will continue to be for persons who have the specialized skills and knowledge to support the professionals in the nation's work force (Ighedo, 1979, p. 25).

According to Ighedo (1979), Nigeria lacks personnel in all the three categories of manpower, especially personnel in the high level category, to perform management and supervisory functions presently performed by expatriates.

Frederick Harbinson (1971) identified the human capital as the wealth of nations. He further singled out high level

manpower as one of the two factors limiting rapid economic growth and therefore recommended the generation of high level manpower an educational priority.

The nature of human capital in the economic development of the developing nations seems to be a critical issue. Damachi (1973) observed that the human capital (shortage of skills) is probably more critical than the shortages of capital funds, whereas the reverse is the case with India.

It can be observed also that Nigeria is experiencing a surplus of manpower. The critical shortages and surpluses of different kinds and levels of manpower have a negative impact on the development and utilization of Nigeria's natural resources. Both the natural and human resources in the country are being under-utilized. In other words, Nigeria has not been able to channel her natural and human resources towards the achievement of economic independence. This claim was supported by Lewis (1966) when he made the following remarks:

> Nigeria's main assets are the human resources and the abundant supply of natural resources. The people of Nigeria may have demonstrated in many areas that they are dynamic, highly adaptable, and ready to absorb with speed the new skills, techniques and attitudes associated with modern and efficient economic development, but the available manpower resources have not been geared towards the attainment of clearly defined national goals. The abundant labor supply therefore remains as in most other developing countries, a major source of economic waste and instability. The high level of unemployment, notably among school leavers, is widely regarded as one of the most serious social and political problems facing Nigeria (p. 25).

Shortage of high level manpower is not peculiar to Nigeria alone. It seems to be a common phenomenon in Africa at large. Drake (1965) writing on social change and social problems in contemporary Africa made the following remarks:

> The leaders of new African nations plagued by shortage of highly trained technical personnel, have been critical of the existing universities. The system established throughout Africa was, naturally enough, patterned after the universities in the metropolitan countries and having close connection with particular institutions (p. 251-252).

The root of the problem of skilled manpower shortage has been traced to the curriculum of our existing educational institutions and educational policies. The type of education given to our youth seems to be out of step with our needs. According to Drake (1965):

> Educational policies designed to prepare a highly sophisticated elite in broad intellectual matters did not meet the needs for technicians and administrators and also educated the elites away from the people (p. 251).

Abubakar (1969) stressed that Nigeria needs a curriculum reform that reassesses both the content and the methodology of the existing curriculum. He recommended that the contents of the science courses should be such that it is interesting, relevant to the pupils' experiences, with physical world, and structured in a continuous development of scientific concepts and skills from the primary school up to the university level.

Expressing the serious nature of the lack of technical skills in Nigeria, Arnold (1977) emphasized thus:

> Nigeria is an economic mixture of boom and backwardness. In the pursuit of advancement, young graduates take jobs to find themselves under old incompetents who know nothing and do nothing except cling to a position they are ill-equipped to hold. Consequently, the graduates become disillusioned. In a society where education is thrusting forward a new generation with skills not previously, or at least not widely available, this kind of situation is common enough (p. 78).

Lack of sufficient capital

Lack of sufficient capital is probably the most obvious problem of industrialization in developing nations. Oni and Onimode (1975) contend that the major difficulty has been the neglect of the role of technological progress as a necessary attendant of capital formation for economic development. They attributed the lack of sufficient capital in Nigeria to the imperialist domination of the Nigerian financial sector which operates through foreign ownership and control of commercial banks, insurance companies and allied monetary institutions.

Since economic development requires capital which Nigeria lacks, then major investments have to be required from the outside sources. As a result of this, a large part of the Nigerian industrial scene is dominated by foreign investors.

Iloeje (1973) had a different view about why capital formation is a problem in Nigeria as opposed to some developed countries of the world. Although there is no basis for comparing Nigeria with the advanced countries of the world, he wrote:

> Our country (Nigeria) is not endowed with such a rich and extensive mineral deposits as South Africa's gold which would have formed a basis of wealth and capital. Nor do we possess a colonial empire such as Britain had which would have buttressed our industrial development. We have just ourselves emerged from colonial status, so earlier industrialization was not possible (p. 130).

About the quantity of mineral deposits in Nigeria, Iloeje (1973) went further to say:

> Some key minerals that are essential to large scale industrial development have not been found in large enough quantities in our country. In the Ruhr (West Germany), in the South Wales (Britain), and in Pennsylvania (USA), industries are built on a foundation of good coal, iron, and limestone which are found in large quantities and in close proximity. We have not yet struck such a fortune. There are traces of iron around Enugu, and recent experiments indicate that coke could be produced from out coal, yet these minerals are not of the Pennsylvania quality, nor of the Ruhr variety and quantity (p. 130).

While the importance of capital availability in economic development could be realized, it is important to note that capital and natural resources are regarded as being of secondary importance to the development of human resources. In order to create and employ capital effectively, Nigeria needs entrepreneurs, managers, and technical and professional personnel of all kinds (Damachi, 1973). Education at various levels is of paramount importance for a general development as also are training facilities (Stokke, 1970).

The capital formation, management and skilled labor which are regarded as a limiting factor on industrial development, not withstanding, the future of Nigeria in industrialization process looks very bright. Nigeria is embarking

on continued development of her material and power resources.

The oil production, the Niger dam project, the steel production, and the increase in personnel training programs are all positive indications of prospects of industrialization in Nigeria.

The federal government has increased its commitment to industrial development through the formulation of encouraging policies. Manufacturers are encouraged through loans and grants and some raw materials are being imported into the country duty free while high import duties are being imposed on those goods likely to threaten the security of domestic products.

Attitude of Nigerians to work

The military regime of the first Republic of Nigeria, in an attempt to find a solid base for the nation's industrial process, enacted the 1978 Enterprises Promotion Act. This Act was designed to give Nigerians the opportunity to assume greater responsibility and a measure of control in the management process of the Nigerian enterprises. In addition to the Act, the military categorized the Nigerian business into three schedules: schedule one, exclusively for Nigerians; schedule two, allowing Nigerians 60% participation; and schedule three, with 40% Nigerian participation. This, no doubt, clarified the relative position of the Nigerian populace in the industrialization process.

Unfortunately enough, Nigerians did not utilize the golden opportunity created by the military in the Enterprises Promotion Act. Yakubu (1983), writing in the Daily Times of January 4, 1983, clearly analyzed the factors that impede industrialization in Nigeria, resulting from the 1978 Enterprises Promotion Act. He believes that a manager manages men and materials to achieve the business objectives, that the position of the worker/operatives in the industrialization process of any nation is unique and that the success of any organization depends on the decision of the management to fully and wisely utilize the human and material resources available to him amidst political, legal, cultural and environmental constraints. The Nigerian manager has a lot of constraints to grapple with in the industrialization process. One of these constraints was described by Yakubu as "anti-business". He asked:

> What type of industrialization is a management seeking to achieve when the remuneration of his worker is based on nepotism, party patronage, "this is chairman's uncle", niece, favorites of the general manager, girl-friendism and not on merit, diligence and demonstrable experience and qualification? (p. 7).

He concluded thus:

> In most Nigerian industries today these internal anti-business policies are pursued with vigor as if they all form the major objectives of the establishment (p. 7).

Okorie (1982) questioned whether productivity can increase in Nigeria considering the negative attitude of most Nigerians to work. He felt that the problem of Nigerians

has to do with work ethics characterized by lethargy and carelessness.

Perhaps we are waiting for the expatriates to do all the work for us while we sit back and fold our hands. According to Johnson Adosomwan, the president of Jera Management Consultants:

> The Japanese (for example) won't come to revive our economy. The solution must be found by Nigerians, although we may emulate the consistency of the Japanese (Okorie, 1982, p. 7).

Quite often, the government is responsible for the workers' inefficiency and incompetence. Most of the time, what the government does influences everybody in the organizational hierarchy, and with pockets of incompetence at the top, all others are bound to follow suit. Inefficiency is almost institutionalized and Nigerians lack leadership by example. Ironically when a Nigerian worker resigns and establishes his own business, he works very hard and his productivity is at an optimum. That is why productivity in public companies is always low.

In order to increase productivity in Nigeria and thus achieve a realistic industrial growth and development, two recommendations have been advanced. Yakubu (1983) recommended that:

1. All the antibusiness vocabularies in the business circle should be got rid of to give the Nigerian industrialization process a boost.

2. Two representatives of the workers union should be represented on the company's board of directors to establish a communication link between the management and the operatives since ineffective communication has been the major cause of industrial upheaval in Nigeria.

The participants of the seminar on the improvement of productivity in Nigeria believed that despite the multifarious problems, productivity could be increased through the application of what they referred to as the total productivity model (TPM). This is the ratio of tangible output to tangible input, where both are measured in value terms with respect to base period. They made the following recommendations (Yakubu, 1983):

1. That the Total Productivity Model be given a trial through collective involvement and participation of well motivated workers in the appreciation of the need for positive change.
2. Training, leadership by example, the use of organized program and feedback.
3. Technology utilization and transfer as well as research development.

In addition to the above, there is a need to place greater emphasis on the value of work in the instruction of children from the primary school up to the university level.

Education in Nigeria

Historical development

The history of educational development in Nigeria dates from the advent of the Christian missions to the coastal areas

of the Southern Provinces in 1842. This was 19 years prior to the establishment of the Colony of Lagos (1861). For many years, the missionary societies controlled education, and the educational system of the former Southern Nigeria is largely the creation of the missionary efforts.

The Northern provinces, on the other hand, did not become a protectorate until 1900. Missionary work started there at a much later date than in the South with the result that developments in the educational field proceeded at a different pace and in different directions.

The first mission to come to Nigeria, the Wesleyan Methodist Missionary Society, was established in 1842. It has its strong base at Badagry. This mission was followed by the Church Missionary Society (CMS) and the United Free Church in 1847.

During these periods, these missions established schools through which they propagated their religious faith. The first high schools for boys and girls were established in Lagos in 1878 by the Methodist Mission. In 1849, the Church Missionary Society (CMS) opened a teacher training institution at Abeokuta. Later, this mission extended its influence to the Niger area. In 1895, the United Free Church opened the Hope Waddell Institute in Calabar. This institute served as a trade and vocational training center for the preparation of teachers and pastors.

The Catholic Mission came into the picture in 1868, with the establishment on the Lagos Island, of St. Gregory's College in 1876. By 1880, it extended its educational activities over several areas of Yorubaland and across the Niger at Asaba and Onitsha. By 1885, the Catholic Mission spread to the different parts of the Eastern Province.

The American Baptist Mission came to Nigeria in 1853. Beginning its educational work in Egba of the Yorubaland, it spread to different areas of Yorubaland.

The Qua-Iboe Mission, a Protestant Society, established in Eket and Uyo districts of the cold Calabar Province. In 1894, the Primitive Methodist Missionary Society established in Calabar and Owerri provinces.

Government established its presence in the educational field before 1909 with the opening of Government School at Nassarawa near Kano. By 1913, it expanded into two elementary, one primary, one secondary, and one technical school.

Until 1944, formal education in Nigeria was in the hands of the Christian missionaries while the government's involvement was restricted to small-scale financial contributions.

The second world war saw an increased demand for education in the country, especially in the Southern Provinces. This led to a substantial increase in primary school enrollment. The federal government took over the initiative and today state governments run almost all formal education in Nigeria.

From the beginning, Nigeria's formal educational system was structured on the basis of the Western pattern of primary, secondary and tertiary levels with heavy emphasis on general education.

The Ten-Year Development Plan of 1946 made provision for the extension of facilities for secondary and teacher education in Nigeria. Through the Sydney Phillipson report published in 1948, schools were assisted by government on the basis of efficiency and suitability to the needs of the location which they served. Also, the Ten-Year Plan together with the Revised Plan for 1951-1956 recognized the urgent need for the training of skilled craftsmen and artisans equipped with sufficient knowledge to adapt themselves to the changing conditions. Included in this plan was the provision of a wide variety of courses based on satisfactory standards of general education.

Some of the well-known technical institutes established during this period include Yaba Technical Institute, the Enugu Trade Center, the Kaduna Trade Center, and the Yaba Trade Center. The courses offered at these trade centers include carpentry, bricklaying, machine fitters, motor mechanics, cabinet making, printing and decorating, welding, sheet metal work, electricity and wood machinery. Today, technical institutes and trade centers are found in almost all the states of the Federation.

The former Nigerian College of Arts, Science and Technology was established in 1950 as a result of a grant from the Colonial Development and Welfare. The college had branches at Ibadan, Zaria, and Enugu. Its main objective was to provide technical education at the higher levels while the lower level work was left for the trade centers and technical institutes.

The Ashby Commission report of 1960 emphasized the need to expand secondary and higher education and to gear the output closely to expected high level manpower needs.

Today in Nigeria, the trade centers and technical institutes are giving way to the polytechnics and colleges of technology. As of now, there is a total of 24 polytechnics and colleges of technology across the nation.

Technical education and manpower development

The shortage of manpower at the intermediate level has already been stressed in this chapter. This was estimated at 13,200 for the third plan period (1975-1980), and this figure was distributed among the building and construction industries, technicians and technologists in different areas of industry, some areas of medical profession, accounting assistants, the maintenance technicians and so on.

The statistics published by the National Manpower Board indicate that Nigeria needs at least three persons in the paraprofessional, technical and teaching categories for every

university graduate. Abubakar (1969) estimated that for each technologist, 7 technicians, 60 craftsmen and 120 operatives are required for optimum efficiency. The best that Nigeria has ever achieved is less than half of the number needed to meet the needs of the country.

As a result of Nigeria's inability to generate its own manpower, it has been depending on technical manpower from abroad to work in government services and private industries. The number of foreigners employed in the country which largely come from Western Europe and North America and from Asian countries (e.g., Lebanon, Israel, India, Taiwan, Hong Kong, Japan) was relatively low before the civil war (2,300) and 1,800 on the average for the years 1967 to 1969. The share in the total number employed in the manufacturing industry oscillates around 2.5%. This refers exclusively to trained personnel who perform management and supervisory functions (Ludwig, 1973, p. 135).

Ludwig (1973) reported that, between 1964-1969, the share of foreign nationals in the management of industry (managers and senior staff) was relatively constant at 55 to 60%. In addition, foreign personnel generally occupy the more responsible positions within the company hierarchy compared with their Nigerian colleagues.

A few steps have been taken by the federal government to control the number of foreigners employed in Nigeria. As

formulated in the Second National Development Plan (Federal Ministry of National Planning, 1971), "it is the primary objective of economic policy to reduce the extra dependence of the economy on foreign employees" (p. 318). The aim of this policy was to replace the greater part of foreign personnel in industry and trade with Nigerians by 1980. Nigerianization of management through the reduction of the number of working permits to foreigners by government was one of the measures taken to achieve the above objective.

Nigerianization of management is not uniform across the country. It is more pronounced in the southern half of the country than in the northern half. In 1968 for example, less than half of the management positions in the South were occupied by foreigners whereas the figure for Northern Nigeria was about 73% (Ludwig, 1973, p. 135). According to Ludwig (1973), the reason for the high proportion of foreigners in the North is primarily the lack of trained personnel from this part of the country. Relatively few managers in the North came from the South before the civil war. Today, most of the managers in that part of the country are foreign nationals.

Table 5 shows the ratio of foreign to Nigerian managers and senior staff by location. The ratio of foreign to Nigerian employees is highest in the northern states.

The practice of recruiting foreign nationals as

Table 5. The ratio of foreign to Nigerian managers and senior staff by location[a]

States/location	Percent of foreigners	
	In management & senior staff positions	In total number of industrial employees
Lagos State	50	2.5
Western & Midwestern	41	1.5
Northern State	73	2.6
Total in Nigeria	55	2.4
Lagos	50	2.6
Abeokuta	32	2.1
Ibadan	40	1.9
Benin	20	0.4
Sapele	41	1.4
Maidugri	53	1.2
Jos	60	2.8
Kano	77	2.4
Kaduna	84	2.6
Zaria	51	2.9
Ilorin	48	3.9

[a]Source: S. Ludwig (1973, p. 135).

technicians, scientists, and other categories of skilled personnel, no doubt, has increased the cost of economic development in Nigeria. There are considerable differences in the salaries paid to foreign and Nigerian managerial staff; the foreigner receives an earned income which is on an average 2.5 times higher than that of a Nigerian senior staff member.

Nigeria is not by any means aiming at complete elimination of foreigners, realizing that foreign specialists are

needed with respect to passing on technical know-how or technology transfer as in the introduction of new production and management methods developed in the advanced nations. The extensive growth planned for the industrial sector in the Fourth National Development Plan will even necessitate an increase in the number of foreign industrial personnel in the short-term.

Nevertheless, skilled manpower shortage has been a matter of increasing concern in Nigeria. Arnold (1977) attributed the shortage partially to the Nigerian educational snobbery which is biased against the middle level skilled man. According to him, the system tends to produce many intellectuals and too few technicians. He cited a survey carried out in 1972 indicating that 7% of advertised vacancies for doctors were unfilled, 20% of pharmacists, 5% of all categories of engineers, 9% for school teachers, 14% for accountants, architects, town planners, surveyors, research and production chemists. At the intermediate level for general research, it was 23%.

Comparing Nigeria's manpower status with other countries of the world, Dr. Abashiya, the director of the Staff Development Center at Kaduna, pointed out that by 1975, in other countries, there was a ratio of six technicians to one professional, while in Nigeria, the ratio is one to one (New Nigeria, August 6, 1975). He further condemned the snobbish

attitudes in education and the fact that the country's cultural heritage made people look down on those at the lower rungs of the ladder.

It is very disheartening that Nigeria has not given an appropriate attention to technical education in this country. In his address to the National Association of Technological Students (NATS) during its second Presidential Summit at Auchi Polytechnic, Dr. Titus Ohikhena, the Bendel State Commissioner for Education, postulated that the economic salvation of this country (Nigeria) lay in her rapid advance in technological education. He argued that, although this fact had been recognized over the years by successive governments of this country, too little had been done to give impetus to technological education (Dimawo, 1983, p. 7).

It should be recalled that even though development planning started in Nigeria in 1945, very little attention was given to manpower planning until the 1960s. Again, successive Nigerian governments paid lip service to the concept of evolving an educational system attuned to the needs of the country. It was only in 1962 that the federal government began to search for a better education for the country. A delegation of educational administrators and teachers was sent to Britain, the United States of America, Europe and South American countries to study the aspects of education in those countries and make recommendations. In 1968, a

National Conference on Education was held in Lagos in an attempt to develop an educational philosophy for Nigeria. Unfortunately, this attempt failed.

Today, Nigeria is faced with the pressing need of an expanding economy. The existing educational system, patterned in line with the British-colonial system simply cannot meet these needs since the emphasis of this system is largely based on white collar jobs rather than technical aspirations. Onyemelukwe (1966) stated that the emphasis which the colonial administration laid on literary education and the delay in accepting the need for nationally planned technical education directed at the provision of skilled manpower affected technical education adversely. Ogunshe (1971) holds that the salary scales in force were probably too low to generate a sufficiently high demand for trainee technicians. He also attributed skilled manpower shortage to the dearth of qualified students with a good grounding in secondary school science and the high cost of establishing and maintaining technical schools.

The federal government, in the past, has taken a number of steps to alleviate the problem of skilled manpower shortage aimed at upgrading the skills of workers. The first step was the establishment of the National Board for Technical Education by General Gowon's regime, in 1975. The Board was formed to operate on the lines of the National Universities

Commission with the responsibility of developing and disbursing funds for the technical education programs. Under this program, the federal government approved a grant of over $1.5 million to the states in support of technical education programs. The Yaba College of Technology together with the three others in the other parts of the country were specifically designed to help meet the ever-increasing demand for middle level manpower.

It has been estimated by the Council of Heads of Technological Institutes (COHEAD) (1982) in Nigeria, that by the time the existing 24 polytechnics and colleges of technology developed to their optimum size of 7000 students each, the overall student population would reach 168,000. With the proposed federal polytechnics in each state, the population could further be increased to 252,000. The council hopes that operating at optimum levels, the output for the polytechnics should meet the technical manpower requirements of the country for the foreseeable future.

The Council of Heads of Technological Institutions in Nigeria (1982) made an analysis of the problems facing the existing polytechnics and the huge financial requirements to set up and run an efficient polytechnic. It declared:

> It is the view of COHEADS that if adequately funded, the existing Polytechnics can conveniently meet the nation's expected technological manpower requirements. Proliferation of polytechnics without first taking care of training facilities for staff would not have a good effect on the economy. The high cost and

> staffing problems aside, further attempts to over-produce will lead to massive unemployment of people whose training cost a fortune. It must be realized that there will be grave dangers when we prematurely run into graduate unemployment at this stage of our development (p. 17).

Another important step taken by the federal government was to step up and alleviate management education and training with the establishment of a Center for Management Development. This body has been developing a series of training programs in an effort to solve the problem of skilled manpower shortage.

Similarly, the Industrial Training Fund (ITF) has increased the scope of its activities in the area of financing and development of practical training courses particularly for Nigerian engineers. In addition, the federal and state governments have increased and intensified the on-the-job training for workers.

Despite the above training programs, Nigeria still lacks sufficient skilled manpower with the result that the nation has to go ahead with a high level of expatriate management in construction and manufacturing, the medical profession and in the upper echelon of the teaching profession.

Several authors have advanced different ways and means of resolving the problem of technical manpower shortage in Nigeria. Abubakar (1969) suggested the following steps:

1. The technical profession should be made more attractive by improving the status of the technician and giving him better pay.

2. Technical teachers ought to be given more encouragement by allowing them to work as part-time industrial consultants; and industrial technicians and technologists should be used as part-time teachers in technical institutions.

2. Technical education should receive a greater share of our educational budgets than it is getting now. There is an urgent need to open more technical colleges so that each state has at least one technical college.

4. Agriculture was by far the largest industry in Nigeria and the training of technical agricultural extension workers and other training personnel should be given high priority.

5. The future of our economy very much depends on the development of small scale industries especially in the rural areas. Therefore, the training of tradesmen and technicians for these small industries should not be ignored in drawing up technical education programs.

6. Since technical education exists to serve industry, public and private, industries should be closely associated with technical education by participating actively in policy making, manpower planning, curriculum development, provision of opportunities for industrial experience and consultancy service (p. 200-201).

Adaralegbe (1969) recommended that our institutions should teach science and technology if Nigeria should achieve progress in agriculture, health and mineral resources. He recommended the following in order to achieve the above:

1. The teaching of science at all levels;

2. The training of more scientists and science teachers;

3. Mounting a crash program for the intensive training of non-science students in science subjects at university level;

4. Providing opportunity for science curriculum reform;

5. Training technologists and technicians in sufficient quantity and quality;

6. Ensuring availability of manpower, relevance of projects of national needs and interests, and setting up a priority scale of programs for research;

7. Developing a national science policy under a central body to promote, coordinate and execute scientific research;

8. Introducing science and technology into all training college curricula;

9. Encourage girls to take up science and technological training;

10. Involving industry and business in meaningful participation in science and technical education as well as scientific research (p. 209-210).

In order to promote science and technological education in Nigeria, the chairman of the House of Representatives Committee on Science and Technology, Honorable Samuel Alu recommended that 3.5% of the nation's GNP be devoted to science and technology. The idea was welcomed by the scientists and technologists in the country. As a matter of fact, this group of scientists has been advocating for a substantial increase in government funding of science and technological subsector (Amadi, 1982, p. 3).

Callaway (1971) also suggested that the best way to encourage youth to take up technical careers is to make it worthwhile by adjusting wage scales and by providing an economic environment in which more technical jobs are available or can be self-created.

Industrial arts in the Nigerian secondary schools

The Federal Ministry of Education (1977), in its National Policy on Education, stated thus:

> At the very early phase of the education system, efforts must be made to inculcate an attitude of respect for an appreciation of the role of technology in society. To accomplish this, elementary technology will be introduced in the school curriculum as early as possible. Pupils will be exposed to using their hands in making, repairing and assembling things (p. 19).

Here the Ministry is referring to industrial arts education in the secondary schools, especially in the junior secondary schools:

> The National Policy on Education also indicated that the junior secondary school will be both prevocational and academic, it will be free as soon as possible and will teach all the basic subjects which will enable pupils to acquire further knowledge and develop skills (p. 19).

The introduction of prevocational training as a comprehensive element at the junior secondary level is one of the most significant changes in the educational system of Nigeria. Unfortunately, only a few states have made adequate provisions for training in the prevocational subjects. Ogun and Kaduna States are examples of the states that are developing their prevocational education in accordance with their needs.

The practical subjects have been described with several expressions in the Nigerian school system. The expressions presently in use include "pre-vocational", "elementary technology", "introductory technology" and "industrial arts". The latter is used by Ogun and Kaduna States at the secondary

level.

It has been proposed that the junior secondary school curriculum should include the following industrial arts subjects: wood work, metal work, mechanics, electrical work, local craft, technical drawing, home economics, building, and business studies. The following subjects were also recommended for the junior secondary curriculum: mathematics, English, two Nigerian languages, science, social studies, art and music, practical agriculture, moral and religious instruction, physical education and prevocational training. The prevocational subjects are available to all pupils irrespective of sex.

In addition to the above mentioned subjects, French and Arabic were recommended as electives in the junior secondary curriculum. A provision was made by the National Implementation Committee for States to make some modifications in the curriculum in order to meet their respective needs. Some states included technical drawing and building subjects to meet their local needs.

Some subjects labelled "nation-wide subjects" were also recommended for the junior secondary school curriculum. They include mathematics, English, science and social studies.

Prevocational education has been made compulsory for all Nigerian secondary schools. Each student is expected to receive training in each of the subjects mentioned above, for

the three-year duration of the junior secondary program.

The Joint Committee on Education further recommended the following for the junior secondary education:

1. Five periods per week for industrial arts subjects;
2. Each school should have a permanent teacher to teach a subject and coordinate the teaching of part-time teachers where necessary;
3. The choice of part-time teachers will be made by the school curriculum committee taking cognizance of the use of locally available artisans.

Many authors have described the prevocational education popularly called the 3 + 3 system as a step in the right direction. Alex (1983), writing in the Daily Sketch of January 26, 1983, stressed that the new 3 + 3 system emphasizes technical and vocational education in accordance with the modern inventions and innovations. He stated that the policy extends to the universities which are required to diversify programs in order to allow for the development and production of high level manpower within the context of the nation's needs in the economy. Alex recommended the following for the successful implementation of the new scheme:

1. Teachers who are qualified in various technical fields should be recruited.
2. Laboratories and libraries should be well equipped.
3. New buildings suitable to accommodate the increased turn-out of students should be constructed.
4. New textbooks, in accordance with the syllabus for the new system, should be written.

For the new system, government has decided to establish

a science and equipment manufacturing center and a national book development council to produce cheap but good and relevant textbooks, and an education technology center for the production of audio-visual teaching aids--all these are still on the drawing table (David-West, 1982, p. 3). According to David-West, the success of the new system is dependent on the process of continuous assessment of the pupils' day-to-day performance which has to be carried out meticulously as is done in the United States.

The shortage of industrial arts teachers is one important problem facing industrial arts education in Nigeria. This shortage is caused as a result of rapid changes in curriculum content as well as a tremendous expansion of secondary school enrollment. For instance, it is expected that for the 1984/85 academic year, the total enrollment in the Nigerian secondary schools will attain the 5,032,980 mark, according to the National Population Bureau. In the same academic year (1984/85), Nigeria will need about 30,000 industrial arts teachers at the junior secondary level assuming an average of 70% transition from primary to secondary, and five periods a week allocated for prevocational subjects. The total number of teachers for the 1980-81 academic year, in the first three years of secondary education, was 47,000.

The Implementation Committee for the National Policy on Education (Federal Republic of Nigeria, 1977) stated that:

> By 1984-85, there will be a need for approximately 190,000 teachers in secondary schools in Nigeria. This estimate is based on targets set by individual states and 1.5 teachers per class of 40. The current number of teachers in secondary schools can be estimated at about 77,000. Thus in the next three years 2½ times the number of teachers presently available will be required (p. 11).

In recognition of the need for the production of a great number of teachers for the Nigerian secondary schools, both the federal and state governments are making efforts to train sufficient number of teachers for the new scheme. The output of teachers from teacher training institutions is expected to double from 1981 to 1984. The expected output of trained teachers from different programs is shown in Table 6.

Table 6. The expected output of teachers by programs from 1981-84[a]

Program	1980/81	1981/82	1982/83	1983/84
Advanced teachers' colleges	8,642	11,528	14,928	19,747
Universities	2,477	3,074	4,037	4,982
Training abroad	858	1,168	1,610	1,965
Totals (13 states)	11,977	15,767	20,575	26,694
Totals (19 states) (estimated)	15,600	20,500	26,700	34,700

[a]Source: Federal Ministry of Education (1981, p. 11).

Despite government's efforts to increase the output of trained teachers, the shortage of teachers still persists owing to the transition to a 3 + 3 system. It was estimated that the shortage of trained Nigerian teachers for the secondary schools would reach 60,500 mark for 1981-82 to 1984-1985. This therefore calls for the recruitment of teachers abroad. Thirteen states, according to the Implementation Committee, have indicated that a total of 11,400 teachers may be recruited from abroad during the four years.

The federal government has outlined two strategies for increasing the supply of teachers for the junior secondary schools during the 80s. The strategies are as follows:

1. To add to teacher training capacity to meet long-range needs, and
2. To make extraordinary efforts to find teachers for the critical periods of 1981-84 to fill the gap.

The following were considered by government as appropriate approaches for increasing the number of teachers and improving their performance.

1. In-service training
2. Recruitment of retired teachers
3. Deployment of national youth service corps graduates to schools
4. Training students abroad
5. Recruitment of foreign teachers

6. Short intensive course by equipment suppliers
7. Recruitment of local artisans as part-time demonstrators.

Another important aspect of the prevocational education in Nigeria is the provision of facilities. The Federal Ministry of Education, Planning and Development Division (1981) made the following observations:

> A similar expansion can be foreseen with regards to educational facilities where around 30,000 workshop spaces would be needed before 1985. With the average cost per workspace of ₦ 20,000, the total capital expenditure, for all Nigeria, would amount to ₦ 600 million within the fourth plan period (p. 1).

The Ministry also estimated that by 1984-85, there will be a need for approximately 3.6 million pupil-places in the junior secondary schools throughout the nation. By this time also, 5.0 million places will be required at the secondary level.

According to a survey of the 19 states by the Federal Ministry of Education, the estimated cost of equipment needed for the workshops for the prevocational training ranged from ₦ 8,000 to ₦ 220,000. Table 7 indicates the estimated cost of equipment by subject area. Business and wood work have the highest estimates.

The gigantic plan by the federal government to integrate industrial arts curriculum into the general educational system and making it compulsory in all the Nigerian secondary schools is an indication of a bright future for industrial

Table 7. Cost of equipment for a 3-stream junior secondary school

Subject area	Cost (₦)
Woodwork	4,382
Metal work	2,430
Mechanics	2,397
Electrical	505
Building	1,100
Technical drawing	990
Business	7,880
Home economics	2,125
Crafts	500
Total	22,309

[a]Source: Federal Ministry of Education, Planning and Development Division (1981, p. 28).

technology in Nigeria. This plan is most appropriate, especially in a society like Nigeria which is characterized by an ever-increasing rate of change in industry and technology.

Vescera and Dimeo (1982) maintain that preparing youth today for the future is critical and must be addressed by education in general and industrial education in particular. DeVore (1975) recommends the study of technology in the school system for the purpose of developing self-reliant citizens in a future technological society. According to Henry (1982), industrial arts is capable of teaching and, many times, practicing the very latest technology.

Hales and Synder (1982) refer to industrial arts as a discipline of schooling with a body of knowledge that can be

identified, which contributes to technological literacy, and enhances human potential. They went on to say:

> Industrial Arts is a comprehensive educational program concerned with technology, its evolution, utilization, and significance; and with industry, its organization, personnel, system, techniques, resources and products; and their social and cultural impacts (p. 6).

Copeland (1982) indicates that the profession has repeatedly endorsed industrial arts as general education designed to acquaint students with all aspects of industry and technology. But Dugger (1982) found that the perception of industrial arts seems to have changed little in the past seven years. Copeland also reported that the purpose cited as having the highest degree of emphasis was to develop in students a measure of skill in the use of common tools and machines. According to him, this perception is extremely narrow and not consistent with the broad meaning and purpose of industrial arts. He concludes:

> Traditional industrial arts programs of basic shop work where students are introduced to only the use of tools and machines is part and parcel of a past era. Today's creative and imaginative Industrial Arts teacher should be implementing broad learning activities that cover all aspects of industry and technology (p. 12).

A review of the literature reveals that forward-looking industrial arts educators have been proposing change for more than four decades. During the 1940s, 1950s, 1960s, and 1970s, leaders like Warner, Maley, Olson and DeVore proposed curriculums to reflect industry and technology (Copeland, 1982, p. 10).

In a guideline for future programs that focuses on technological alternatives in dealing with identifiable problems of mankind and on promoting the development and application of speculation, innovation and problem solving, Henry (1982) proposes that industrial arts as a unique area of public general education should teach not only occupational clusters and general conceptual knowledge but also should foster adaptability, build technical literacy and provide leisure skills through experience. He remarked:

> By teaching broad concepts (e.g., materials instead of wood or metal, machine principles instead of machine operations) and by emphasizing research rather than manipulative skills, industrial arts can teach and be adaptable to nearly every area of industry (p. 15).

It is important to note that industrial arts programs that focus on individual projects and basic hand tools and machine activities as the major learning experiences do not provide the students with the necessary ingredients for living and adapting in a highly technical society. Emphasizing the need to expose the students to broad experiences, Henry (1982) wrote:

> In the public school setting, Industrial Arts can provide unique experiences such as research, design and actual construction of projects, practicing problem solving with materials and machines, and through practicing quasi-industrial experiences, gaining information on occupations and general industrial functions (p. 15).

There is an abundance of evidence to show that industrial arts leaders have addressed the "teaching of technology",

"technology education" deriving content from technology (Foy, 1982). Understanding of industry, technology and the society, fundamental to Nigerian life should be the primary focus of industrial arts in the Nigerian educational system. Copeland (1982) addressed this issue clearly when he stated:

> If Industrial Arts will ever realize its true potential as a dynamic force in public education, the profession sooner or later will have to implement programs that thoroughly teach industry and technology as a subject (p. 10).

Future prospects for technical education

The demand for better education has been the dream of developing countries involved in development process. Nigeria is no exception. Striving for technological and economic breakthroughs like every country on the continent and determined to break free of dependence upon imported expatriate manpower--to indigenize, Nigeria will snap up voraciously anyone with training, most especially at the middle and managerial levels (Arnold, 1977).

Although industry is carrying out extensive training programs to train workers for their new roles, public education is still required to carry most of the training burden. In its National Policy on Education, the Federal Republic of Nigeria (1977) declared:

> A greater proportion of education expenditure will be devoted to science and technology and universities and their levels of the education system will be required to pay greater attention to the development of scientific orientation. To this end more colleges of

> technology and polytechnics will be opened in a bid to improve technological and science education (p. 10).

The federal government intends to maintain the ratio of science to liberal arts students in the universities as has been fixed at 60:40 during this plan period. This ratio will be subject to review according to the manpower needs of the country.

In order to maintain a constant supply of skilled manpower, it is the policy of government that the five types of technical education institutions outside the university, namely, the prevocational and vocational schools at post primary level, the technical colleges, the polytechnic, and the colleges of technology and teacher education at post secondary level, will continue to exist. The course content in these institutions will be fashioned to respond to the needs for the development of skills in such fields as food technology, clothes manufacture, service and machines and so on which are needed by the economy.

As Aluko (1971) pointed out, the central problem in Nigeria was that the top-level manpower produced by the universities is not supported by an intermediate class and that the facilities of the universities were not fully utilized. With this regard, the federal government encourages cooperation among educational institutions and between education and industry in recognition of the fact that there are limited facilities for technical education in the country.

There is no doubt that Nigeria has stepped up technical education backed by more effective prevocational training. Technical education programs are being more closely related to on-the-job training in public as well as private establishments. The federal government has outlined the aims and objectives which technical institutions should accomplish. They include:

1. To provide trained manpower in applied science, technology and commerce particularly at subprofessional grades. The university of technology should prepare professional grades.

2. To provide the technical knowledge and vocational skills necessary for agricultural, industrial, commercial and economic development.

3. To provide people who can apply scientific knowledge to the improvement and solution of environmental problems for the use and convenience of man.

4. To give an introduction to professional studies in engineering and other technologies.

5. To give training and impart the necessary skills leading to the production of craftsmen, technicians, and other skilled personnel who will be enterprising and self-reliant.

6. To enable our young men and women to have intelligent understanding of the increasing complexity of technology (Federal Republic of Nigeria, 1977, p. 19).

The federal government of Nigeria, in recognition of the role played by science and technology, has created a new ministry--the Ministry of Science and Technology. This ministry took over the responsibilities of the defunct National Science and Technology Development Agency (NSTDA).

Its function includes the following:

1. Formulation of national policy on science and technology
2. Promotion of science and technology research
3. Liaison with universities and federal polytechnics
4. Promotion and administration of technology transfer programs (Federal Ministry of National Planning, 1981, p. 206).

It can be recalled that, in the Third National Development Plan (Federal Ministry of National Planning, 1975), greater emphasis was placed on basic research, the establishment of technical institutions for imparting theoretical knowledge and the training of intermediate level manpower abroad. In the Fourth National Development Plan, provision has been made to intensify technical manpower training and development through direct training, work attachment and extension services.

University Education in Nigeria

Historical background

Burns (1972), Esen (1973), and the Nigerian Handbook published in 1954, have a comprehensive history of the development of university education in Nigeria.

Prior to the development of a university in Nigeria, the Yaba Medical School and the Yaba Higher College served as institutions of higher education. Both institutions were founded in 1930 as a result of Nigeria's need for a center of

higher learning. Courses offered in these institutions included agriculture, forestry, engineering, medicine, surveying, veterinary science and teacher training in arts and science, all for a duration of four years, except medicine and veterinary science.

In the year 1944, two commissions appointed by the Secretary of State, the Right Honorable Oliver Stanley, were sent to West Africa to report on the question of higher education. The first commission headed by the Right Honorable Walter Elliot appointed on the 13th June, 1943, was charged with the responsibility of considering higher education in British West Africa and making recommendations on future university development. The second commission, under the leadership of the Honorable Mr. Justice Asquith, appointed in August 1943, was to consider the principles which should guide the promotion of higher education in the West African colonies and make recommendations on the means by which universities in the United Kingdom might offer assistance. After further investigations and discussions, it was decided to establish a university college at Ibadan.

The University College, Ibadan, was formally opened on the 25th of March, 1948. The Yaba Higher College was closed down and on January 18, 1948, 104 students started their first term as the first set of undergraduates in the University College, Ibadan.

A grant of about $2,850,000 was made available to the university from the Colonial Development and Welfare Fund. As the finances of the college came under the control of the Provisional University College Council in 1948, the federal government voted some funds for recurrent expenditure and for an endowment fund.

The Yaba Medical School was incorporated in the college and both were in association with the University of London. Courses offered in this university included courses of study in the Faculty of Agriculture, Arts, Medicine, and Science. Coexisting with these faculties was also a Department of Extramural Studies and an Institute of Social and Economic Research.

The University of Ibadan, as an affiliate of the University of London, served Nigeria for 12 years before it became autonomous in 1962.

Neither Cyril Asquith, nor Walter Elliot, nor their colleagues in the commissions can be regarded as the foremost or earliest thinkers in terms of a university for West Africa (Esen, 1973). Prior to the Elliot and Asquith Commissions, many prominent Nigerians at home and abroad had fought for the establishment of universities in West Africa. Dr. James Horton, a Nigerian residing in Sierra Leone, in 1868, called for the establishment of a university in Sierra Leone. Dr. Edward Blyden in 1881, Casely Hayford in 1911,

Herbert Macaulay in 1920 and Dr. Nnamdi Azikiwe in 1937, all expressed the need for universities in the continent of Africa.

Following the independence in 1960, Nigeria needed to expand university education. The people, increasingly conscious of the need for a kind of manpower that would be required to cope with the obligations of self-government at all levels, called for the establishment of more universities. The commitments in international relations, economic and industrial development, education, and public health and other social services needed people with the specialized training that only the universities can give; it would have been impossible to train students abroad in sufficient numbers (Esen, 1973).

The establishment of more universities in Nigeria was as a result of the Ashby Report in 1960. The University of Lagos and Ahmadu Bello University established in 1962 were the direct result of the Ashby recommendation. The establishment of the University of Nigeria, the first indigenous university, was endorsed by the Commission's report though "after the fact." The University of Ife was established in 1961 and, in 1971, Nigeria's sixth university was opened in Benin.

It could be seen that the university development in Nigeria has been vigorous. The Nigerian government recog-

nizes the positive and invaluable role which higher education could play in furthering national consciousness and prosperity with the result that subsequent developments have been extensive.

Since Nigeria achieved her independence in 1960, the number of universities in the country has increased from two (Ibadan and Nsukka) to 23 at present. Eighteen of these universities are classified as federal universities.

The Nigerian Universities Commission reported that student enrollment has jumped from 1,400 to more than 70,000 and a total of 100,000 has been projected for 1985. The Federal Ministry of National Planning (1979) projected a total of 108,720 in 1985. Table 8 shows a projected enrollment for the 20 operating universities in Nigeria.

With 23 universities serving an estimated population of 80 million people, Nigeria's ratio of one university to 3.9 million people seems very impressive. Comparing Nigeria with other countries in terms of the number of universities and the population, Esen (1973) reported that Britain has one university for every million inhabitants, the United States has one university per 200,000 people, Ghana has one for every 3 million people, Zaire has one per 5.3 million people, Egypt has one university per 8 million, Tanzania a ratio of 1:12.5, and Sudan 1:15 million people. Nigeria, therefore, has the largest number of university institutions of all countries in Black Africa.

Table 8. Projected enrollments in the Nigerian universities--1981-85[a]

Universities	1980/81	1981/82	1982/83	1983/84	1984/85
Ibadan	8,595	9,557	10,034	10.285	10,485
Lagos	8.894	9,557	10,242	10,585	10,905
Univ. of Nigeria	8,060	8,642	9,411	10,170	10,625
Zaria	10,396	11,122	12,279	12,170	12,985
Ife	8,771	9,217	9,620	10,342	10.675
Benin	3,890	4.660	5.681	6,560	6,985
Jos	3,293	4,135	5,158	6,045	6,610
Calabar	2,751	3,436	4,151	5,031	6,015
Kano	2,775	3,550	4.275	5,035	6,115
Maiduguri	3,393	4,398	5,009	5,685	6,150
Sokoto	1,717	2,532	3,317	4,217	4,625
Ilorin	2,042	2,999	4,204	5,220	6,215
P.H.	1,976	2,504	3,155	3,935	4,830
Banchi	-	400	600	800	1,000
Markurdi	-	250	500	750	1,000
Owerri	-	250	500	750	1,000
Ondo	-	-	250	500	750
Gongola	-	-	250	500	750
Ogun	-	-	-	250	500
Niger	-	-	-	250	500
All universities	66,553	77,209	88,636	99,090	108,720

[a]Source: Federal Ministry of National Planning (1981).

The university of technology

Almost every chapter of the Fourth National Development Plan makes reference to the acute shortage of technical manpower (Offiongodon, 1982). The plan emphasizes the need to provide more engineers and scientists for Nigerian industry owing to the fact that the importance of technical education and the need to generate sufficient skilled manpower have been stressed by many important Nigerians.

Offiongodon (1982) again indicated that manpower shortage in Nigeria has assumed a very wide dimension and ranks high in the list of obstacles impeding rapid economic development. He noted that technical manpower both of high and middle level categories, including engineers, architects, surveyors, doctors, are required in great numbers in sectors like manufacturing and construction.

Clark (1971), stressing the need for industrial engineers in Nigeria industrial development, wrote:

> We need industrial engineers who will be mainly concerned with the synthesis, design, improvement and installation of integrated systems of men, materials, and machines. They must draw upon a broad array of specialized knowledge and skill in the mathematical, physical and social sciences, together with the principles of engineering analysis and design in order to specify, predict and evaluate the results to be obtained from such systems. Modern industrial, municipal and governmental activities have an increasing demand for engineers equipped with the special knowledge and skills required for incorporating complex arrays of men, machines and skills into efficient systems designed to meet exacting objectives (p. 12).

It is apparent that for too long technical education has been relegated to play the second fiddle in the educational structure of Nigeria. Also, it is essential to realize that the rate of industrial development and how the nation copes with the industrial development squarely depends on the skilled manpower which invariably depends on the turn-out of our graduates from the educational institutions that fall into this category (Offiongodon, 1982).

Nigeria is lagging behind some African countries in

technical education. The Committee on Survey of Technical Education reported in 1962 that, for every 10,000 of the population, there were 621 students in technical education in Ghana, 245 in Sierra Leone, 217 in Gambia and only 88 in Nigeria.

Kaita (1981) attributed the lack of technical personnel to the negative attitudes of Nigerians towards technical education. He remarked:

> The unfortunate situation today is that most of the young men and women of Nigeria think that it is more privileged and honorable to be for instance, a lawyer, or a historian, than a technician. The Nigerian society will need to have a better understanding of the sociological aspects of technical education. An excellent plumber is more admirable than an incompetent philosopher (p. 12).

Professor Iya Abubakar has warned that:

> If Nigeria is to rise to any height and gain respect among the community of nations, it must produce the technicians, the technologists and the engineers that can life it to that lofty height. Until our own technicians can forge the bonnet (hood) of the Peugeot car, its wheels, fenders, steering wheel, axle and the screws, we have little to be proud of: (Offiongodon, 1982, p. 5).

Sogbesan (1973) has called for a system of education that should be tailored to the path of national power, industrial strength and ability to make and deliver new weapons through science and technology. He called on the Nigerian universities to develop projects concerning the expansion of existing facilities, especially the technical ones, and establish new disciplines in response to the manpower needs

of the country.

In response to the nation-wide agitation for skilled manpower development as a prerequisite for rapid industrialization, both the federal and state governments have embarked on establishing universities of technology to meet Nigerian needs for high level skilled manpower. Some of these universities have started functioning while others are yet to be opened in the near future.

In an address of welcome by Professor E. N. Chukwu (1983), Vice-Chancellor of the Federal University of Technology, Yola, during the reception of the first students of the institution, he outlined the objectives of the federal universities of technology as articulated by the Vice President of the Federation, Dr. Alex Ekwueme. Professor Chukwu cited Dr. Ekwueme as having outlined the overdependence of the country on goods and services manufactured abroad, and also the need for indigenous technology both in concept and in product, as a way of improving the standard of living of the citizenry and the growth of the national economy. According to Chukwu, Dr. Ekwueme felt that Nigeria could achieve national growth by developing federal universities of technology to augment the nation's conventional universities in those areas of knowledge and human endeavor that Nigeria is meant to pursue. He stated that the new universities "must aim at not merely imparting theoretical knowledge, but, at giving

greater emphasis to practical experience in the field and the development of appropriate skills by their students."

The objectives of the federal universities of technology as outlined in Section 1(3)(a)-(h) of the Act of the University and reported by Professor Chukwu (1983), are as follows:

1. To encourage the advancement of learning and to hold out to all persons without distinction of race, creed, sex or political conviction the opportunity of acquiring higher education in technology;

2. To develop and offer academic and professional programs leading to the award of diplomas, first degrees, post graduate research and higher degrees which emphasize planning, adaptive, technical, maintenance, developmental and productive skills in the engineering, scientific, agricultural, medical, and allied professional disciplines with the aim of producing socially mature men and women with capability not only to understand, use and adapt existing technology but also improve on it and develop new ones;

3. To act as agents and catalysts, through post graduate training, research and innovation for the effective and economic utilization, exploitation and conservation of the country's natural, economic and human resources;

4. To offer to the general population, as a form of public service, the results of training and research and to foster the practical applications of these results;

5. To establish appropriate relationships with other national institutions involved in training, research and development of technologies;

6. To identify technological problems and needs of the society and to find solutions to them within the context of overall national development;

7. To provide and promote sound basic scientific training as a foundation for the development of technology and applied sciences, taking into account indigenous culture and the need to enhance national unity;

8. To undertake any other activities appropriate for a university of technology of the highest standard (Chukwu, 1983, p. 7).

By 1981, three technically oriented universities admitted their first set of students. Although they are operating in temporary facilities with limited enrollment, plans are underway for extensive expansion of these universities in the immediate future. These three federal universities of technology are located in Banchi, Markurdi, and Owerri. Two other ones at Akure and Yola also have started functioning. Others are planned for Ogun and Niger states and the new federal capitol, Abuja.

According to the Nigerian constitution, any state has the power to establish universities within its boundaries to cater to the local needs, interests and sensibilities. All states meanwhile have polytechnics, colleges of technology and advanced teacher colleges and some states have established their own universities. States such as Anambra, Imo, Rivers, and Ondo have universities of technology and other states have shown interest in the establishment of their own.

The role of university in Nigeria

The Nigerian government has adopted education as an instrument for national development, particularly in the development of high level manpower. The universities are one of the best means for achieving this objective. To this end,

Nigeria has appropriated an enormous proportion of education expenditure for science and technology in order to fulfill her traditional aim of producing skilled manpower.

Offiongodon (1982) reported that manpower survey has clearly shown beyond reasonable doubts that the dearth of technical labor is one major factor responsible for the inefficiency of Nigeria public services and the major handicap of implementation of various development projects. He went further:

> Chaotic public services imposed perilous strains on the social life of the people and retarded the economic and industrial progress of the nation. The provisions of the National Development Plan, particularly the current one (1981-1985) in respect of the technical manpower and the increasing awareness and growing concern of the private sector evidenced by its effort to train its employees, is an eloquent testimony of the appreciation of the problem. The massive expansion in the technical and professional education is no doubt one of the means which the federal government wants to use to thwart the problem (p. 5).

Reflecting on the role of universities in the industrialization process, Uwagboe (1971) called upon the universities and industries to broaden the scope of their professional concerns to accelerate scientific and technological progress, modernize enterprises and ensure overall mechanization and automation of production. According to him, the universities should begin to offer courses and programs which will not only provide the graduates in the basic sciences and medicine but also provide the country with engineers and technologists in aeronautics, automobiles, materials tech-

nology, geophysical engineering, petrochemicals, industrial engineering, and agriculture. Uwagboe (1971) further suggested that the universities should consider the expansion of their existing faculties and the establishment of new disciplines with particular reference to planning and administration of industries, to meet the needs of the country in terms of various levels of manpower.

The federal government of Nigeria specified in the National Policy on Education (Federal Republic of Nigeria, 1977) that for the universities to make optimum contribution to national development, the following are essential:

1. A need to intensify and diversify university programs for the development of high level manpower within the context of the needs of the economy.

2. A more effective machinery for identification of manpower needs of the economy to guide the universities on the nation's manpower needs. The National Manpower Board is represented on the National Universities Commission.

3. In the professional fields, course content should reflect our national requirements and consultation will be encouraged between universities, the employers and government. The National Universities Commission should set up an academic planning committee to carry out the academic planning of new universities.

4. As part of a general program of all-round improvement in university education, students will be made to take a course in history and ideas and the philosophy of knowledge or some other such suitable course as may be determined.

5. Measures should be taken to involve the governments, the employers and the universities in a continuous dialogue aimed at creating and maintaining the right

> atmosphere for cooperation with a view to utilizing the talent and expertise of the universities more in national development and decision making than at present.

Cooperation of Universities with Industries

Many writers believe that close cooperation among the universities, the industries, and governmental agencies is necessary for the generation of high level skilled manpower and high quality educational programs. In the United States, Britain, and some advanced countries, such cooperation exists where many of the universities' teaching staff are men from the industry.

In many developed countries of the world, the industries assist the universities in the development of certain faculties or departments. The universities, in turn, assist the industries in research work, in the invention of new formulas and in the development of courses in continuing education and industries and for people engaged in teaching, research and service.

Phillips (1971) warned against the danger of the Nigerian higher institutions operating in isolation from the industries. He added:

> Many people have warned us about getting involved with industry. They suggest that we may perhaps lose our academic freedom. This, however, in my view is an old-fashioned and outmoded idea which is almost entirely discounted now in the United Kingdom and the United States of America. More than one authoritative investigation has been undertaken into the whole matter

> of participation between industries and universities. The Jones Report went so far even to advise that there should be professors appointed directly from industries and that there should be university staff appointed to act as directors in industry (p. 1).

Buckley (1971) stressed the need for the universities and industries to agree on the type of programs to be offered by the universities in the light of manpower requirements and the needs of the economy. He wrote:

> I believe it is preferable if all students are sponsored by firms. This will of course mean that firms will take the industrial training seriously. It also means they have a good knowledge of manpower requirements because firms do not sponsor students unless they need them. The college and employers must agree jointly on the practical course. It should not be left to either separately. The lecturers must go into the industry to see the students in the industry. We also like to see the student tackle a project so that the employer and college can see whether he is getting anything out of his training (p. 72-73).

Buckley (1971) further recommended a cooperative type of program whereby an employer sponsors students, so that when they complete the course, the government will refund part of the cost to the employer.

It is the government's policy that industry and government be consulted in designing courses or programs with a view to giving such courses greater practical relevance. Government also encourages the use of advisory boards, the membership of which will include representatives from industry and employers of labor, for each group of courses and trades. The use of advisory boards will ensure that programs and courses satisfy the needs of industries and employers.

Clark (1971) would like to see a close working relationship between the industry and the universities in Nigeria in order to meet the needs of the individual and society. He expressed this need in the following remarks:

> We have asked ourselves in this country a number of questions as to whether our present institutions of higher learning have satisfied the basic educational requirements of our society. How many of our university authorities have thought or asked themselves whether the students they turn out from their institutions actually go into the field to render useful services in the areas of specialization for which they were alleged to have been trained? How many of the engineers, agriculturists, and technologists produced are actually actively employed in their professions and with minimum satisfaction. How many of them are honest and dedicated to their jobs as a result of the training they had in the universities. A large proportion of the graduates produced by our institutions have not been able to fit themselves squarely into the society to which they belong as a result of their training (p. 5-6).

As a result of the type of training received by the Nigerian youth, the average Nigerian graduate has a negative attitude to work. He has not received practical training as part of his education. Clark (1971) concludes thus:

> The young Nigerian graduate has been made a victim of circumstances because the universities have failed to prepare him to take his rightful place in the society and do not even care to what happens to him thereafter. The industries suspect him and regard him as a liability rather than an asset (p. 7).

In the light of the above, the Nigerian universities should engage in the development and enrichment of their academic programs and the adjustment of their curriculum and teaching methods towards meeting the needs of the Nigerian

society. Maintenance of a close and constant contact with the industry, government and other agencies through research, conferences, short courses etc is of paramount importance. According to Wolansky (1981), a close working relationship between education leaders, labor leaders, and research and development representatives will ensure that planning for vocational technical education is based on adequate and current employment market information, specific job-related skills and behaviors, and scientific and technological impacts.

Technology explosion has contributed to a changing environment for the Nigerian worker who has to master new skills and tasks. The universities, in cooperation with industry should offer refresher or sandwich courses of study for employees of industries. This type of training will:

1. Prepare them to effectively fulfill future responsibilities relating to their employment,
2. Enhance their advancement potential with the industry, and
3. Bring them near to modern advances in their professions, thus increasing their effectiveness in their present jobs.

Research Studies in Industrial/Technology Education

Industrial arts education

A lot of studies have been conducted in different areas of industrial arts education. Most of these studies are

concerned with the content, purposes, goals and objectives of industrial arts education in the United States. Crawford (1971) discussed in detail the scope and sequence of content in the 20th Yearbook of the American Council on Industrial Arts Teacher Education. Ray and Streichler (1971) observed that the main difference between industrial arts education and industrial technology programs are found in the undergraduate level programs. The differences, according to them, lie in the state certification standards, the existing conventional programs that have evolved over the past 50 years, and the problem of breadth versus depth.

The issues of technical knowledge and skills in their respective curricula have always been a matter of concern to the industrial arts teachers and the industrial technologists. Lewis (1970) conducted a study in an attempt to determine the relevance of some selected areas of the industrial technology curricula to the expectations of industry. He discovered that there is a need for further study to determine the nature and extent of curricula content in the technical depth area. Both industry and education were found to express a need for a technical specialty.

Where to draw a line between industrial arts teacher education and industrial technology has been a controversial issue. Dean (1969) stated that the two areas, if possible, should be regarded as separate entities each with its own

budget, faculty, courses and facilities. He expressed that, even though the two areas have some similarities, they have different objectives and different clientele. Erber (1969) questioned this view and wondered how a teacher can "adequately" convey and properly assist students in the formulation of modern and functional concepts in regard to materials, tools, machines, machine systems, instruments, and processes without the depth of technological study of the industrial technologist. He emphasized that problem-solving activities within these technologies demand that the technological background of the teacher parallel that of the industrial technologist (p. 56).

Because of the alleged criticisms that there is a lack of agreement among educators on the objectives, content and standards of achievement in the industrial arts profession, the American Vocational Association (1934) in Standards of Attainment in Industrial Arts Teaching published a list of 12 objectives for industrial arts. These included:

1. To develop in each pupil an active interest in industrial life and in the methods of production and distribution.
2. To develop in each pupil the ability to select wisely, care for, and use properly the things he buys or uses.
3. To develop in each pupil an appreciation of good workmanship and good design.
4. To develop in each pupil an attitude of pride or interest in his ability to do useful things.

5. To develop in each pupil a feeling of self-reliance and confidence in his ability to deal with people and to care for himself in an unusual or unfamiliar situation.

6. To develop in each pupil the habit or orderly method of procedure in the performance of any task.

7. To develop in each pupil the habit of self-discipline which requires one to do a thing when it should be done, whether it is pleasant task or not.

8. To develop in each pupil the habit of careful, thoughtful work without litering or wasting time (industry).

9. To develop in each pupil an attitude of readiness to assist others when they need help and to join in group undertakings (cooperation).

10. To develop in each pupil a thoughtful attitude in the matter of making things easy and pleasant for others.

11. To develop in each pupil a knowledge and understanding of mechanical drawing, the interpretation of the conventions in drawings and working diagrams, and the ability to express his ideas by means of a drawing.

12. To develop in each pupil elementary skills in the use of the more common tools and machines in modifying and handling materials and an understanding of some of the more common construction problems (p. 12).

The American Vocational Association (1968) in its publication, Guide to Improving Instruction in Industrial Arts, reduced the above objectives to five goals of industrial arts. They are:

1. Develop an insight and understanding of industry and its place in our culture.

2. Discover and develop talents, aptitudes, interests, and potentialities of individuals for the technical pursuits and applied sciences.

3. Develop basic skills in the proper use of common industrial tools, machines, and processes.

4. Develop an understanding of industrial processes and the practical application of scientific principles.

5. Develop problem-solving and creative abilities involving the materials, processes, and products of industry (p. 9-11).

In 1947, the industrial arts curriculum was modified to reflect technology. As a result, six major areas were included in the curriculum. These areas included management, communications, construction, power, transportation, and manufacturing.

Olson (1957) later attempted to reclassify the industrial arts curriculum on the basis of industry and an analysis of industrial arts functions. He identified eight categories, namely, manufacturing, construction, power, transportation, electronics, research, management and services.

Industrial technology

Relatively few studies have been done in industrial technology. This is because "the search of literature dealing specifically with four-year industrial technology programs revealed limited activity prior to 1961" (Anderson, 1983, p. 40). According to Anderson, the scarcity of research may evidence the lack of a recognized degree program prior to that time.

Keith (1966) conducted a study in an attempt to deter-

mine common goals for four-year industrial technology programs, study programs in other colleges and develop criteria for the programs. Sixteen criteria were formulated based on this study. The criteria were as follows:

1. The catalog should reflect the purposes of the program.
2. Ideally, the teaching staff should have from two to five years industrial experience, 15-30 semester hours of professional preparation, 18-40 semester hours in special allied areas and at least a master's degree.
3. Proficiency in teaching is essential.
4. Writing for publication is important.
5. The program should consist of a sequence of respective areas or disciplines.
6. The scholastic level of the students in the program should be equal or above that of other students in the school.
7. Graduates of the program should be qualified for employment in more than one type of industry.
8. The program should be accepted and actively supported by the administration of the school.
9. The areas and disciplines included in the program of study should contribute towards the purposes established for the program.
10. The practices for selecting students should be such that only those students who could successfully complete the program would be admitted.
11. Enrollment should be related to the needs of industry.
12. Staff load should permit the maximum contribution of each faculty member.
13. The physical plant should provide sufficient space and up-to-date equipment to meet the requirements of the program.

14. The fiscal allocation should be sufficient to support the program.

15. An advisory committee of employers, graduates, parents and educators should be consulted.

16. Staff members should be actively identified with professional, educational and industrial organizations (Keith, 1966, p. 243-251).

Boaz (1965) conducted a study aimed at ascertaining the status of four-year technology programs with respect to the employment and success of their graduates among other things. The graduates studied indicated that 52% had entered an occupation directly or indirectly related to their training. The remaining 48% found broader opportunities, better salary or greater self-interest in employment that was unrelated to their training. The study also showed that the employers of the graduates rated them high in job performance and character but were critical in the areas of leadership and experience.

Harris (1969) made an investigation into the criteria for self-evaluation of a four-year industrial technology program for the purpose of establishing a more empirical basis for making decisions on curricular content. The following evaluation criteria were proposed based on the study:

1. The major objectives of the four-year industrial technology programs should be clearly defined and available for examination.

2. The organizational structure developed for administering the four-year industrial technology programs should be adequate to facilitate the achievement of the stated purpose of the program.

3. Procedures and policies for the securing and retention of qualified faculty personnel need to be clearly defined, in written form, and geared to promote proficiency in teaching.

4. Procedures and standards for the selection and admission of prospective students in industrial technology should be clearly defined, in written form, and reflect the stated purpose of the industrial technology programs.

5. Complete records on students should be developed and retained as a basis for counseling and guiding students in their education activities.

6. The curriculum of the industrial technology programs should reflect in a clear and logical way an attempt to implement the stated major objectives of the programs.

7. Instruction in each course should be directed towards clearly formulated, comprehensive objectives which are designed to achieve certain of the overall goals of four-year industrial technology education.

8. Opportunities should be provided students to broaden and intensify their knowledge and understanding of the cultural aspects, philosophical aspects and purposes of industrial technology education as these relate to industrial employment and effective contributions to society.

9. Opportunities should be provided students in industrial technology to broaden their competencies in oral and written communication.

10. The programs in industrial technology should provide students opportunities to develop insight and skill in human relations.

11. Opportunities should be provided students in industrial technology to broaden their knowledge and understanding of the principles of management, supervision and administration, as applied to the industrial enterprise.

12. The program in industrial technology should provide students opportunities to broaden their knowledge and understanding of technical subject matter, and its applications to industrial situations.

13. The facilities and resources associated with the programs in industrial technology should be adequate to achieve the stated goals or major objectives of the program.

14. Revisions should be made based upon constant review and self-evaluation of the programs in industrial technology (p. 235-236).

A study by Kozak and Richards at Texas State revealed that the following areas should be emphasized in industrial technology programs: production management, manufacturing cost analysis, quality control, and production planning and scheduling. Woodworking, foundry, architectural drafting, computer-assisted drafting, civil drafting, electronic drafting, descriptive geometry, and structural drafting were considered unimportant (Anderson, 1983, p. 52).

The United Nations Research Institute for Social Development (1973), in an attempt to ascertain the main objectives of vocational education in developing countries, surveyed some experts from those countries. The study revealed that a great majority of the experts thought it was highly important to teach trainees how to work in modern enterprises with punctuality, regularity and efficiency (83%), and almost the same proportion also agreed on the need to bring about sufficient familiarity with maintenance and repair (82%). More experts also stressed training for various job possibilities through emphasis on polytechnical skills and transfer of training (68%) than teaching trainees how to do one specialized job well in modern productive activities (52%).

Some of those who advocated multi-skill training rather than specialized training pointed to the actual employment conditions in most developing countries. The polytechnical approach is particularly suited to a country in its early stage of development. It concentrates on a basic trade with other related trades. The trainees can easily find employment in his basic trade and has other options, particularly in a country such as Nigeria. Countries in their early stages require a general machinist but as industry becomes more specialized the general machinist course can be subdivided into specialized courses, such as lathe turning, precision grinding, milling etc. (p. 91).

The study also showed that vocational training in developing countries should concentrate on the teaching of proper working methods rather than on a set task, in order to prepare trainees better for industrial development.

Strom (1970) conducted a study at the University of Northern Colorado. The purpose of the study was to determine the extent the existing four-year industrial technology curricula in the state of Minnesota were meeting the needs of Minnesota industries. He found among other things that:

1. Minnesota industries were willing to consider the possibility of providing resource instructors on a limited basis to assist in college instruction of highly technical or specialized topics within the industrial technology programs.

2. Of the universities surveyed, 73% expressed the desire to establish work experience programs in cooperation with the industrial technology institutions.

3. Approximately 70% of the industrial firms were willing to accept the responsibility of functioning in an advisory capacity towards industrial technology programs in that state.

4. The industrial technology graduates employed in Minnesota industries were most frequently employed in management, industrial engineering, product development and supervisory positions.

Summary

The review of related literature shows that three factors contribute an appropriate environment for industrialization. They are resources, institutions and technology. Nigeria possesses the natural resources in great quantity but the quality of these resources is questionable. Although the institutions are present, the appropriate technology to develop the abundant resources is lacking.

Nigeria lacks sufficient men and women with appropriate skills and technical know-how needed for the production of goods and services that can compete favorably in the world market. Because of the lack of appropriate skills and technical know-how, Nigeria depends heavily on goods and services manufactured abroad thereby draining its foreign exchange earnings.

Nigeria has not given appropriate attention to technical education and very little attention was given to manpower planning until 1960s. The shortage of skilled manpower is attributed to the Nigerian educational snobbery which is

biased against middle level skilled workforce.

For Nigeria to acquire high technology in order to compete favorably with comparable industries in the world market, it should promote its indigenous manpower development. The review of literature shows that the country is making some positive efforts in this direction. Nigeria is planning to create an attitude of respect for an develop an appreciation of the role of technology in that country. Elementary technology is being introduced in the junior secondary school curriculum whereby students are exposed to using their minds and hands in making, repairing and assembling things.

It is critical that Nigeria achieves continued growth by adopting and harnessing high technology through the development of universities of technology which together with industries will serve as data bases and information centers. These information centers must be reoriented to take note of technological changes happening in Nigeria and outside and carefully monitor both technology and social trends in order to modify the curriculum to meet the needs of the country.

The people of Nigeria must be made aware of their misplaced sense of tradition in the midst of wants and poverty through publicity and information. According to Kriegbaum (1983), information is the true source of power both personally and nationally, and poverty is defined as much in terms of information poverty as in terms of poverty of goods.

The imperative, therefore, is the need for training to enable the skilled workforce to employ high technology and competitively manufacture goods for domestic and export purposes.

CHAPTER III. METHOD OF PROCEDURE

This chapter describes the procedures adopted for the study. The procedures have been divided into the following headings:

1. Population and sample
2. Instruments for data collection
3. Analysis of data.

Definition of Population and Identification of Sample

The population for the study was composed of industrial technology/engineering faculty of the federal universities of technology in Nigeria. Directors/managers/top executives of the Nigerian industries, administrators of technical education in the ministries of education of the 19 states in Nigeria and the Nigerian graduate students currently enrolled in industrial education/technology in the American universities.

Within this population, the following constituted the sample used in the study:

1. All industrial technology/engineering faculty members in the five operating universities of technology including the University of Nigeria.
2. Directors/managers/top executives of 100 manufacturing industries randomly selected from the four main

zones across the Federal Republic of Nigeria. These zones included the North-Central, the South-East, the Mid-West, and the Western industrial zones. The industries were identified using the Directory of Registered companies/factories in Nigeria.

3. Nineteen administrators of technical education in the 19 Ministries of Education in Nigeria.
4. Forty-two Nigerian graduate students currently enrolled in industrial technology/education in selected United States universities.

Development of the Instrument

The research was initiated in the summer of 1982. The researcher submitted the research proposal to his sponsor, the Federal Ministry of Education, Scholarship Division, Lagos, Nigeria, and to the Sigma Xi, the Scientific Research Society, Connecticut, through PREPS office at Iowa State University (Appendix B). The Sigma Xi declined to fund the research because the total amount of money asked for by all the applicants was much more than they had available to award. However, the Federal Ministry of Education, Lagos, approved the sum of $1,800 to cover the cost of return air ticket to Nigeria.

The data for this study were collected by means of written questionnaires and personal interviews. Only two groups of

respondents, namely, the university personnel (program coordinators) and the industry personnel, were interviewed. The objective of the interview with the program coordinators in the departments of industrial technology/engineering in the Federal Universities of Technology was to obtain information about the nature and scope of their industrial technology programs.

In the case of the industry personnel, the interview served to obtain information regarding their relationship with higher educational institutions (universities and colleges of technology) in Nigeria. The interview also served to ascertain the status of the Nigerian graduates employed in the industry, with respect to their training, and the extent of acceptance of the programs offered in the Nigerian universities. The information elicited from the two groups of respondents through the interviews provided a part of the data base for the study.

The developed questionnaire was structured in four parts. The first part sought information about the personal characteristics of the respondents. The second part sought information about curriculum approaches by industrial technology programs for students' adjustment to technological changes in Nigeria. Part three of the questionnaire dealt with the occupational areas that should be emphasized in the industrial technology programs in the light of manpower demands at

present and projected requirements, students' interests and the requirements of industry. Finally, part four sought information about how industrial technology programs and or curriculum will be evaluated.

There was a total of 88 variables (including several in the personal data section) that required answers by the respondents. Ideas for questionnaire items used in the study were gathered previously from the literature review.

Pilot of Testing of the Instrument

The first draft of the questionnaire was reviewed by the researcher's major professor. Corrections were made and then presented to the graduate committee for another review. Based on the committee's suggestions and comments, the questionnaire was revised.

The questionnaire was distributed to the current Nigerian students in the Department of Industrial Education and Technology at Iowa State University. Their responses and comments were utilized to further evaluate and revise the questionnaire.

Collection of Data

The researcher travelled from Ames, Iowa to Nigeria on the 29th of December 1982 to collect data for the research. In Nigeria, the selected 100 industries, the 19 state

ministries of education, and the four new Federal Universities of Technology, and the University of Nigeria, Nsukka were visited. The questionnaire was given to each subject and allowed sufficient time to complete it. Only about five people completed the questionnaire during the researcher's first visit. The researcher, however, made appointments with the respondents to come and pick up the completed questionnaire at their convenient times. Many subjects did not keep the appointments. They were either not available or perhaps did not complete the questionnaire when they were visited several times in their offices. A total of 10 subjects from the three groups, however, promised to mail the questionnaire to the researcher at Iowa State University. Five people did mail it but the other five people did not. In addition to the questionnaire, the program coordinators in the Department of Industrial Technology/Engineering in the Federal Universities of Technology and the industry personnel were interviewed.

The visits to the respondents of the research questionnaire in different parts of the Federal Republic of Nigeria spanned a period of two and a half months.

Upon return from Nigeria to the United States, the researcher mailed 42 questionnaires to the Nigerian graduate students enrolled in industrial technology/education programs in selected United States universities, on March 8, 1983. Cover letters and self-addressed stamped envelopes for return-

ing the completed questionnaires were enclosed.

The number of questionnaires returned by the four groups of respondents was as follows:

	Number issued/sent	Number returned
Group I (university personnel)	30	30
Group II (industry personnel)	100	55
Group III (administrators of technical education)	19	10
Group IV (graduate students)	41	38
Totals	190	133

A total of 133 responses were received from the four groups. This figure represented a total of 70% return. The different categories of information gathered from these groups were used to analyze the data for this study.

Analysis of Data

The data obtained from the returned questionnaires were coded on IBM forms for keypunching in order to facilitate the computer analysis.

The questions that were answered in the study were:

1. What curriculum approaches should be emphasized in the Federal Universities of Technology for industrial technology programs to contribute to students' adjustment to technological changes in Nigeria?

2. What occupational areas should be emphasized in industrial technology program planning in response to national manpower demands, students' needs and the requirements of industry?

3. How should the programs and or curriculum be evaluated?

Each of the above questions encompassed a number of items which the respondents rated on a five-point scale. This method of summated ratings employing the Likert scale makes use of the ordinal values.

An analysis of variance (ANOVA) for one way classification with unequal n's was used. This design yields an F-value. The analysis design, put in statistical form, is represented by:

$$X_{ij} = \mu + \alpha_j + e_{ij}$$

where:

X_{ij} is the ith score in the jth group

μ is the average of the J population means

α_j is the difference between the mean of the jth population, μ_j, and μ

e_{ij} is the difference between X_{ij} and μ_j, the mean of the jth population.

Assumption: For this analysis, it was assumed that:

(1) $n_1\alpha_1 + n_2\alpha_2 + n_3\alpha_3 \ldots n_J\alpha_J = 0$

(2) the variances (σ) are equal with independent samples.

According to Borg and Gall (1979), the first step in the statistical analysis is to calculate the descriptive statistics. Using the statistical program known as SPSS, Statistical Package for the Social Sciences, the following were used to analyze and summarize the data:

1. The mean scores: These were computed for all the four groups in the study for all items or factors specifically related to each research question.
2. Standard deviations: These were computed for the four groups in the study.
3. Frequency counts and percentages were also employed in the analysis of data.
4. Analysis of variance (ANOVA): These were computed for each of the results of the four groups. If the F-value was significant at the 0.05 probability level, then the Scheffé's multiple range test was employed as post hoc analysis to find out where the differences among the groups existed.

The analysis of data indicated that some of the variables on which there was consensus among the four groups were rated low on a five-point scale and some of the items were rated very high; significant differences were found between the groups. The data were further analyzed using scatterplot analysis to compare the four groups in six different combinations.

The scatterplots were used to eliminate the group item responses that did not fall within the cluster and also to enable the reader to see the whole set of data.

In order to make the final judgment about which of the variables to be identified for emphasis, based on the specified ratings of the four groups, the overall means of the

four groups were considered. The cut-off point was set at 3.99, and only those variables that were rated by the four groups as "highly important" and above were identified for emphasis in the industrial technology programs.

Tables and graphs were presented to clarify discussions and findings. Finally, recommendations were made based on the results of the study.

CHAPTER IV. FINDINGS

The major findings are based on the data collected by means of questionnaires and interviews with personnel from industry and program coordinators of industrial education/ technology or technology engineering departments in the five Federal Universities of Technology in Nigeria.

The findings include the personal data of the respondents, the relationship between the universities and industries and other specific items. These items relate to the curriculum approaches that should be emphasized in the Federal Universities of Technology for industrial technology programs, the occupational areas that should be emphasized in the industrial technology programs in response to national manpower demands, students' needs and the requirements of industry, as well as the evaluation components of the programs and or curriculum.

Personal Data of the Respondents

Sex distribution

The questionnaires were distributed to a total of 190 respondents representing university personnel, industry personnel, administrators of technical education, and graduate students enrolled in technical education programs in the United States of America.

The data reported in Table 9 display the sex distribution of the specific groups responding to the questionnaires. The table also indicates that only 4 females (3%) participated in the study, which indicates that the sample of the study included predominantly males (97%).

Table 9. Sex distribution of the respondents of the study

Sex	No.	%
Male	129	97.0
Female	4	3.0
Total	133	100.0

A total of 133 respondents completed the questionnaires out of the 190 persons that received the questionnaires. This represents a 70% return. Table 10 shows the distribution of the groups of respondents by response of the questionnaires. The 55 personnel from industry (41.4%) and five university personnel (program coordinators) were also interviewed in addition to completing the questionnaires.

Represented states where the respondents were employed

The geographical locations of respondents by state were also considered. It was found that 74.4% of the people surveyed were working in the southern states while 28.6% were

Table 10. Distribution of groups of respondents by response of the questionnaire

Respondent	No.	%
University personnel	30	22.6
Industry personnel	55	41.4
Technical education administrators	10	7.5
Graduate students	38	28.6
Total	133	100.0

working in the northern states at the time of the survey. The regional states of employment of the respondents in of geographical locations are shown in Table 11.

Table 11. Regional states of employment of the respondents

Regional states	No.	%
Southern states	95	71.4
Northern states	38	28.6
Total	133	100.0

Origin of respondents by nationality

The origin of the respondents by nationality was also considered in the study. Table 12 indicates that a total of 117 persons (87.9%) were Nigerian nationals while 16 respondents (12.1%) were foreign nationals. The foreign nationals were distributed among university teaching staff, industry personnel (directors/managers) and administrators of technical education specifically in the northern states.

Table 12. The national origin of the respondents

Nationality	No.	%
Nigerians	117	87.9
Foreigners	16	12.1
Total	133	100.0

Age of the respondents

The age distribution of the respondents is displayed in Table 13. It was found that 31.6% of the people surveyed were between 20 and 30 years of age, 53.4% were between 31 and 40 years, 14.3% between 41 and 50 years, and only 0.8% were above 51 years of age. The age distribution of the respondents, therefore, indicated that a majority of ages reported ranged from 31 to 40 years.

Table 13. Age distribution of the respondents

Age group in years	No.	%
20-30	42	31.6
31-42	71	53.4
41-50	19	14.3
51 and over	1	0.8
Total	133	100.0

Years of experience in the job

The respondents were asked to indicate the number of years of experience in their respective jobs. Table 14 reveals that a majority of the respondents (42.9%) at the time of the study were relatively new in their jobs with less than 5 years of experience. It was also found that 30.1% had been in their jobs between 6-10 years, 15.8% between 11 and 15 years, and 10.5% had over 15 years of experience.

Present level of highest academic qualifications

Another factor considered in the study was the highest academic qualifications of the respondents at the time of the study, as presented in Table 15. Considering the total sample, 74.4% had earned university or technical university degree, 21.1% had Higher National Diploma (HND), a certifi-

Table 14. Years of job experience

Years of experience	No.	%
0-5	57	42.9
6-10	40	30.1
11-15	21	15.8
Over 15	14	10.5
No response	1	0.8
Total	133	100.0

Table 15. Highest academic qualifications of respondents in the study

Qualification	No.	%
University or technical university	99	74.4
College of technology	28	21.1
Technical school	5	3.8
Institutional vocational training	0	0.0
West African School Certificate	1	0.8
Total	133	100.0

cate offered by colleges of technology. Only 3.8% and 0.8% had technical school or higher school certificates, respectively. It was also observed that a majority of the respondents were university graduates who attended either regular universities or technical universities/colleges within or outside Nigeria.

Relationship Between the Universities and Industries and the Status of These Programs Offered in the Nigerian Universities or Other Higher Educational Institutions

This section was designed to find the relationship existing between the universities and industries with respect to cooperative educational or training programs prior to this study. Two groups of respondents, namely, the university personnel (program coordinators in industrial technology) and the industry personnel were interviewed. The interviews generated information regarding the status of the Nigerian college graduates with respect to their training.

Relationship between the universities and the industries

The program coordinators in the departments of industrial technology/engineering technology in the four federal universities of technology and the University of Nigeria, Nsukka, were asked whether or not their institutions conducted cooperative educational or training programs with industries with regard to industrial attachment programs, internships,

exchange of personnel, and seminars. Table 16 shows the program coordinators' responses regarding cooperative educational or training programs. The federal universities of technology, Yola, Markurdi, Akure, and Owerri, indicated that they had not established any cooperative educational programs with the industries because the universities were newly established and their curriculum was still being planned. Only the industrial education section of the department of vocational education, University of Nigeria, Nsukka, by virtue of its longer existence, coupled with previous financial support from the Ford Foundation, has worked in close cooperation with some Nigerian industries. The four federal universities of technology, however, indicated their willingness to cooperate with the industries as soon as their curricula were fully developed and implemented. The Federal University of Technology, Yola, has planned to allocate one-fifth of the five-year program in industrial education to industrial service to prepare its students for industrial attachment. The Federal University of Technology, Markurdi, also has planned to establish a "miniature industry" within the department of engineering technology to create an "on-campus" based industrial setting. This will complement and supplement its planned cooperative programs with the Nigerian industries.

Asked whether they have in the past cooperated with the Nigerian universities and other institutions of higher

Table 16. Program coordinators' responses on present cooperation with the industries

Institution	Kind of response	
	Yes	No
University of Nigeria, Nsukka	X	
Federal University of Tech., Akure		X
Federal University of Tech., Markurdi		X
Federal University of Tech., Owerri		X
Federal University of Tech., Yola		X

learning, 85.5% of the industry personnel indicated that they had been cooperating with the Nigerian higher institutions other than the new federal universities, as indicated in Table 17.

Table 17. Industry personnel's response on cooperation with universities and higher educational institutions

Kind of response	No. of industries	%
Yes	47	85.5
No	8	14.5
Total	55	100.0

The cooperation, according to the industry personnel, had been in the areas of different aspects of engineering and the allied sciences. Only 14.5% of the industry personnel indicated that they had not been cooperating with the higher educational institutions. However, they indicated their willingness to cooperate with the educational institutions if they had time and the opportunity to do so.

The status of the Nigerian college graduates with respect to their training in college

The industry personnel were asked whether or not the college graduates they hired were adequately trained in college to meet their (employers') needs for skilled manpower. Table 18 shows that 72.7% of the respondents indicated that the Nigerian college graduates were not adequately trained to meet their needs for skilled manpower while only 27.3% of them reported that the graduates were adequately prepared to meet their needs for skilled manpower.

Table 18. Responses of the industry personnel on the status of the college graduates

Kind of response	No. of industry personnel	%
Needs met	15	27.3
Needs not met	40	72.7
Total	55	100.0

The reason given by the industry personnel for the new college graduates' inability to meet their needs for skilled manpower was that the graduates lacked practical knowledge of industrial processes. On the other hand, those industry personnel who held that the Nigerian college graduates were meeting their needs for skilled manpower argued that college graduates should not be expected to acquire all the practical knowledge while in school. They maintained that appropriate practical knowledge and experience should be acquired by the industry worker as he/she works and grows on the job.

Some of the industry personnel who indicated that the university programs were not meeting their needs suggested that the Nigerian universities should orient their programs more towards practical/project experiences. They proposed the combination of 70% hardware engineering and 30% management courses as opposed to what is obtained currently in the engineering programs, 70% management courses and 30% hardware engineering.

Nature and scope of industrial technology/education or engineering technology in the federal universities of technology

The interviews with the program coordinators in the industrial technology/engineering technology departments in the federal universities of technology indicated that the programs designed to produce graduates for industrial production and services were known by different names. At the

Federal University of Technology, Akure, the program is called Engineering Sciences which is under the school of Pure and Applied Sciences. In the Federal University of Technology, Yola, the program goes by the name of Technology Education which is in the School of Sciences and Technology Education. In the Federal University of Technology, Markurdi, the program is called Engineering Technology, while the Federal University of Technology, Owerri, has the same programs as Federal University of Technology, Markurdi.

The University of Nigeria, Nsukka, has the engineering departments (civil, mechanical, electrical, and agricultural) in addition to the industrial education section of the department of vocational education.

With the exception of the University of Nigeria, Nsukka, the other four new federal universities of technology have not fully started operating their industrial technology/engineering technology programs because the lecturers to teach the courses are not available in sufficient numbers at this early stage of institutional development. Also, the lack of adequate facilities and equipment seems to pose some added problems in the provision of the total programs.

The four new federal universities also indicated that they are presently offering Engineering Drawing, Workshop Practice, the basic sciences, general studies, for their engineering technology students as an interim measure pending

the full development of their curricula and availability of sufficient teaching staff.

The program coordinators of industrial technology or engineering technology in the five universities surveyed were also asked whether or not such names as industrial technology, technology education, engineering technology and industrial vocational technical education influence the nature and scope of their programs. They unanimously agreed that such names do not influence the nature or scope of their programs or curriculum offerings as long as the names connote technology or engineering and as long as the department offers quality programs to meet the needs for skilled manpower requirements in Nigeria.

Summary of the Background Findings

A majority of the respondents surveyed in this study were males (79.0%) with the age range from 31 to 40 years. The female respondents constituted a very small percentage (3.0%). Of the total number of 133 persons who provided data for the study, 22.6% were university lecturers, 41.4% were industry personnel (directors, managers), 7.5% were technical education administrators in the State Ministries of Education across the Federal Republic of Nigeria, and the other 28.6% were Nigerian industrial technology graduate students studying in the United States of America.

It is interesting to note that 87.9% of the respondents in the four groups that participated in the study were Nigerians while only 12.1% were foreign nationals. Also, 71.4% of the respondents were working in the southern states and 28.6% were working in the northern states at the time of the study.

Another factor considered in the study was the highest academic qualifications of the people surveyed. It was found that a majority (74.4%) had a college degree while less than 1.0% had only a high school certificate or its equivalent. Also, 73% of the respondents had varying experience in their respective jobs ranging from one to ten years.

The study revealed that the federal universities of technology had not established any cooperative education or training programs with the local industries because they were newly established at the time of the study. However, these universities indicated they intended to cooperate with the industries as soon as their curricula were fully developed and implemented.

It was found that 85.5% of the Nigerian industries had educational ties with the older Nigerian universities and other higher educational institutions by way of exchange programs, internships, industrial attachment programs, seminars, and symposia. This cooperation has been established in the areas of engineering and allied sciences. Only 14.5% of the

industries had not had any educational cooperation with the universities, but they indicated their willingness to do so.

Regarding the status of the Nigerian university graduates employed in industries, 72.7% of the industry personnel indicated that the graduates lacked the appropriate skills and practical knowledge and therefore were not meeting their (employers') needs for skilled manpower. However, the 27.3% of the industry personnel who held that the college graduates were meeting their needs for skilled manpower argued that it is the responsibility of the universities to give theoretical training and industries to give practical training to the college graduates upon entry into the world of work.

The study also revealed that the question of using different names to describe technology education was a matter of semantics. The important thing, according to the program coordinators in the universities surveyed, should be for the departments to offer quality programs with greater emphasis on hardware engineering and lesser emphasis on management courses.

Findings Related to the Questions of the Study

This study focused specifically on the problem of investigating the curriculum approaches, occupational emphasis, and program evaluation components of industrial technology programs within the Nigerian federal universities of technology.

Questions of the study

The analysis and interpretation of the data were designed to answer the questions of the study as stated in Chapter I. The questions were as follows:

1. What curriculum approaches should be emphasized in the federal universities of technology for industrial technology programs to contribute to students' adjustment to technological changes in Nigeria?
2. What occupational areas should be emphasized in industrial technology program planning in response to national manpower demands, students' needs and the requirements of industry?
3. How should the programs and or curricula be evaluated?

For each of the three questions, a list of items was generated in order to answer the questions. The responses of the respondents to the items were analyzed. For each item, an ANOVA was computed in an effort to identify areas of significant differences and areas of consensus among the four groups of respondents surveyed. The Scheffé's Multiple Range Test (at .05 and .01) was employed to find out where the differences among the groups existed, but the researcher relied heavily on the overall group means in order to identify the items or factors to be emphasized in the industrial technology programs. The Scheffé's test was used specifically for the

purpose of identifying significant differences in the group responses.

Findings Regarding the Curriculum Approaches to be Emphasized in the Federal Universities of Technology for Industrial Technology Programs to Contribute to Students' Adjustment to Technological Changes in Nigeria

A list of 43 variables was developed and the respondents asked to rate them according to the degree those variables (curriculum approaches) were important for students' adjustment to technological changes in Nigeria.

For the purposes of statistical analysis, the variables were further grouped under four subheadings:

1. Research/philosophical approach
2. Strategic planning approach
3. Occupational guidance approach
4. Cooperative approach.

The statistical methods used in the analysis of data were mainly related to the frequency distribution and the mean. The frequency was used to exhibit the distribution of the items and the mean to indicate the average rating of the items. The standard deviation shows the degree of dispersion of the values around their means.

The scale of 1 to 5 used in the questionnaires indicates ranking from "not important" to "extremely important", respectively. Hence, the higher the frequency of ratings of points 4 and 5, the stronger the agreement with the statement,

and the higher the mean. Conversely, the higher the frequency of rating of points 1 to 3, the lower the mean.

Research/philosophical approach

Twelve variables were identified under research/philosophical approach. Table 19 shows the overall mean, standard deviation and analysis of variance for the items grouped under research/philosophical approach.

Table 19 reveals that there was consensus among the four groups in seven items or variables, while significant differences were found among the groups on five variables at the 0.05 and 0.01 levels. The consensus or agreement among the respondents indicated that the four groups shared identical or similar views on the variables.

It is important to note that consensus on the variables between or among groups should not be interpreted to mean a high rating or that the variables were considered highly important. However, the variables with high ratings suggested that the respondents perceived them to be highly important and therefore should be emphasized in industrial technology programs.

It was noted that most of the differences were found between group 4, that is the graduate students, and the other three groups. For instance, there was significant difference between the students and the industry personnel with respect to variables (or items) 40 and 25, which related to

Table 19. Mean, standard deviation and analysis of variance related to research/philosophical approach

Research/philosophical approach[a]	Overall mean	Std. dev.	F-value
1. Providing the students with experiences in problem-solving through research, creativity and concept development with basic tools and requirements fundamental to all industries or occupations (13)	4.41	0.72	1.18
2. Familiarizing the students with maintenance and repairs in sophisticated equipment so that they can later handle technical equipment themselves (37)	4.33	0.94	2.58
3. Providing instructions and learning activities in several occupational areas to reveal students' talents in technological and scientific fields, industry requirements and natural needs (11)	4.28	0.88	5.00**
4. Providing the students with research and problem-solving activities to enable them to acquire skills in the process of acquiring knowledge rather than just receiving it (18)	4.27	0.79	1.61
5. Teaching trainees how to work in modern enterprises with punctuality, regularity and efficiency (36)	4.23	0.94	2.45
6. Providing opportunities for students to learn industrial processes and production through building projects that stimulate visual, mental and physical capabilities (24)	4.19	0.94	3.16*

[a]Numbers in parentheses represent item number in the questionnaire.

*,**Significant at 0.05 and 0.01 levels, respectively.

Table 19. (Continued)

Research/philosophical approach	Overall mean	Std. dev.	F-value
7. Emphasize skill and technical knowledge in the programs rather than just broad general understanding (28)	4.17	0.87	1.37
8. Teaching trade that could ultimately lead to gainful employment (29)	4.03	1.10	2.71
9. Developing industrial leadership in the students so that they might better prepare themselves for future development (40)	3.93	1.06	6.49**
10. Involving students in problem-solving situations which involve meaningful application of other college subjects (25)	3.90	0.95	10.81**
11. Emphasizing experience in mass production, product design and labor relations to give the students insight into industrial procedures (time and motion study (31)	3.86	1.03	2.19
12. Teaching some basic concepts and skills that are required by students to work in industry irrespective of their occupational areas (terminology, process, safety, materials) (16)	3.82	1.04	3.33*

"developing industrial leadership abilities in students" and "involving students in problem-solving situations." There also were significant differences between the students and the industry personnel regarding item 16 dealing with "teaching some basic concepts and skills required in industry irrespective of the students' occupational areas." Another significant difference found was between the university personnel and the industry personnel regarding "involving students in problem-solving situations involving meaningful application of other college subjects." The mean for the university personnel on this variable was 4.33, while the mean for the industry personnel was 3.40.

The differences among and between the groups may be attributed in part to the differences in educational background of the respondents. The student group might have been influenced by the United States educational system since they were studying in the United States at the time of the study, hence they rated most of the items higher than did the industry personnel.

Strategic planning approach

Seven variables were identified as strategic planning approach to curriculum. The variables under this group did not receive a high rating by the respondents. Table 20 shows that the highest rating in that group was 3.99.

Table 20. Mean, standard deviation and analysis of variance related to planning strategies

Planning approach[a]	Overall mean	Std. dev.	F-value
1. The industrial technology programs should be based on the economic trends, manpower needs and students' interests (22)	3.99	1.10	3.73*
2. Establishing a personnel needs survey as a guide against unemployment and underemployment of graduates of the program (50)	3.84	1.04	0.96
3. Plan a budget for equipment and supplies--current and projected, based on student enrollment (49)	3.83	1.14	1.21
4. Survey various occupations occasionally to determine trends that might affect job requirements and conditions in the future (19)	3.53	1.07	11.37**
5. Selecting appropriate module or units of instruction a students should take to develop the skills necessary to work in a particular occupational area (32)	3.61	1.02	5.30
6. Emphasizing production of a cadre of key personnel for economic and technological development (39)	3.59	1.06	3.03*
7. Giving the students the opportunity to participate in the planning of course content (20)	2.59	1.30	9.68**

[a]Numbers in parentheses represent item number in the questionnaire.

*,**Significant at 0.05 and 0.01 levels, respectively.

There was agreement among the groups on three variables and significant differences on four variables. The significant differences were found between the students and the industry personnel and between the students and the university personnel.

One important area worth mentioning, where significant differences were found between group 4 (students) and group 2 (industry personnel) and between group 4 and group 1 (university personnel), was in the area of "giving the students the opportunity to participate in the planning of course content." Table 20 shows that this particular variable received the lowest overall group mean. While the university personnel and the industry personnel gave low rating to the variable (2.20 and 2.16, respectively), the technical education administrators and the students rated the variable relatively higher (3.0 and 3.39, respectively) as shown in Table 21.

The data in Table 21 also indicate that the four groups rated the variable relatively low.

Occupational guidance approach

There is always a need in vocational education to provide career guidance to students to increase their awareness of varied job opportunities and changing requirements for career entry and advancement as a result of technological advancement.

Twelve variables that address occupational guidance were identified. The respondents rated seven of these variables as

Table 21. Mean, standard deviation and analysis of variance by group in relation to students' participation in planning of course content

Group	Mean	Std. dev.	F-value
1	2.20	1.10	9.68**
2	2.16	1.29	
3	3.00	1.25	
4	3.39	1.13	
Total	2.59	1.30	

**Significant at 0.01 level.

highly important curriculum approaches to be emphasized in industrial technology programs.

Table 22 shows the ratings of the variables by the respondents.

Scheffé's Multiple Range Test indicates that there were significant differences among the four groups in their rating of six of the variables. These differences were found between groups 2 and 4, that is the industry personnel and students. Groups 4 and 1 were found to differ significantly on one variable, the same variable on which group 4 and group 2 differed.

The areas of significant group differences (at .01 and .05 levels) include:

1. Teaching students to understand the effects of technological advances on production of goods and services in industry.

Table 22. Mean, standard deviation and analysis of variance relating to the occupational guidance approach

Occupational guidance approach[a]	Overall mean	Std. dev.	F-value
1. Including contents in the industrial technology programs that are based on industrial procedures and problems, thus giving the students a realistic picture of conditions prevailing in the world of work (12)	4.31	0.77	1.48
2. Teaching students to understand the effects of technological advances on production of goods and services in industry (10)	4.17	0.90	7.03**
3. Teaching students to understand how technological advances have changed the lives of people and to consider future conditions which may affect them (9)	4.10	0.96	5.56**
4. Establishing public relations activities in order to educate the Nigerian public in the potential of industrial technology in the economic development of Nigeria (50)	4.06	0.98	2.18
5. Organizing field trips to industries to help students improve their knowledge of industry, working conditions and work atmosphere (14)	4.02	0.92	0.18
6. Training students for various job possibilities through emphasis on polytechnical skills and transfer of training so that they are always ready to adjust to new situations (38)	4.00	0.94	2.23

[a]Numbers in parentheses represent item number in the questionnaire.

**Significant at the 0.01 level.

Table 22. (Continued)

Occupational guidance approach	Overall mean	Std. dev.	F-value
7. Familiarizing the students with the problems and prospects of industry and Nigerian society in order to motivate students to further their education (17)	3.99	0.99	4.74**
8. Offering more time remedial assistance to students having problems in practical courses (30)	3.86	0.92	2.50
9. Providing the students with resource materials or occupational opportunities (44)	3.77	0.99	7.72**
10. Familiarizing the students with problems found in industry and employment by organizing small companies operating with personnel, manufacturing and marketing systems (Enterprise method) (26)	3.68	1.08	4.52**
11. Exposing students to many occupational areas in their freshman year so that they understand the training requirements, working conditions and salary/wage structure which may affect their occupational change later on (15)	3.62	1.15	5.79**
12. Selecting new and different equipment which parallels the equipment the students will use after graduation (34)	3.43	1.28	2.39

2. Teaching students to understand the effects of technological advances on the lives of people.

3. Familiarizing the students with the problems and prospects of industry and Nigerian society.

4. Providing the students with resource materials on occupational opportunities.

5. Familiarizing students with problems in industry and employment by enterprise method.

6. Exposing students to many occupational areas in their freshman year, so that they understand the training requirements, working conditions and salary/wage structure which may affect their occupational change later on.

Although these significant group differences were found especially between the industry personnel and the students, six of the variables were rated 4.00 and above as shown in Table 22.

Cooperative approach

Although the educational institutions are responsible for the selection and implementation of appropriate knowledge and skills for students, they should operate in cooperation with industry and the community to keep abreast of technological advances in the world of work.

Twelve variables were identified under cooperative approach to curriculum development. The four groups of respondents surveyed agreed that occupational progress in industrial technology should be determined through cooperation among the National Universities Council, education planners, industry and labor ($\bar{X}$ = 4.23). There also was agreement among the

groups regarding the organizing of conferences and seminars by education and industry in order to keep abreast of technological developments and also improve the on-the-job instructions ($\bar{X}$ = 4.07).

Other variables considered under the cooperative approach received relatively lower rating from the four groups of respondents as shown in Table 23.

It was found that the four groups differed significantly on five variables as shown in Table 23. There were significant differences between the industry personnel and the industrial technology students in the following areas:

1. Giving the students the opportunity to work cooperatively in groups to develop cooperative, communicative and leadership skills needed in the world of work.
2. Preparing and maintaining a comprehensive list of, and developing channels of, communication with experience stations for students' planned occupational programs.
3. Establishing a comprehensive list of resource people in the community along with community resources that can be implemented in the instructional programs.

Significant differences at 0.05 level were also found between the industry personnel and technical education administrators and between the university personnel and the technical education administrators regarding "familiarizing the students with management policies and organization structures of training sponsors."

Table 23. Mean, standard deviation and analysis of variance related to the cooperative approach to curriculum development

Cooperative approach[a]	Overall mean	Std. dev.	F-value
1. Occupational programs should be determined through cooperation among the National Universities Council, education planners, industry and labor in order to meet the social and economic needs of Nigeria (21)	4.23	0.96	2.93
2. Organizing conferences and seminars with employers in order to keep abreast of technological developments and also improve the on-the-job instructions (42)	4.07	0.96	0.90
3. Encouraging students to read and interpret drawings and blueprints used in industry (27)	3.99	1.05	0.97
4. Developing and maintaining training plans with cooperative employers (43)	3.90	1.00	1.02
5. Familiarizing the students with language and technical terminology used in training programs to facilitate communication with the trainer, and also comprehend the difficult concepts involved in the training programs (41)	3.85	1.05	1.70
6. Giving the students the opportunity to work cooperatively in groups in order to develop cooperative, communicative and leadership skills needed in the world of work (23)	3.80	0.96	4.61**

[a]Numbers in parentheses represent item number in the questionnaire.

**Significant at 0.01 level.

Table 23. (Continued)

Cooperative approach	Overall mean	Std. dev.	F-value
7. Maintaining a liaison with federal, state, and local employment agencies (45)	3.75	1.07	2.26
8. Developing a cooperative training agreement between students, school, and employers (47)	3.74	1.06	2.46
9. Preparing and maintaining a comprehensive list of, and developing channels of, communication with experience stations for students' planned occupational programs (33)	3.66	0.98	2.39**
10. Maintaining a current file on jobs and employers (46)	3.43	1.13	4.49**
11. Familiarizing the students with management policies and the organizational sturctures of training sponsors (48)	3.67	1.04	3.32*
12. Establishing a comprehensive list of resource people in the community along with community resources that can be implemented in the instructional programs (35)	3.04	1.19	8.44**

*Significant at 0.05 level.

Curriculum approaches to be emphasized in the industrial technology programs

The analyses of variance of the data relating to the curriculum approaches indicated that there was consensus among the four groups on 23 items and significant differences (at 0.01 and 0.05 levels) on 20 items. However, consensus and

significant differences on the items would not be interpreted to mean that the variables were considered important as to be emphasized in the industrial technology programs.

The analysis of data also indicated that some of the items on which there was consensus among the four groups were rated low on a five-point scale and some of the items rated very high (e.g., 4.0 and above), significant differences were found between the four groups.

As a result of the above, therefore, the data were subjected to further analyses using a scatterplot. The mean item responses of the four groups of respondents were scatterplotted in the following combinations:

Group 1 with group 2

Group 1 with group 3

Group 1 with group 4

Group 2 with group 3

Group 2 with group 4

Group 3 with group 4

The scatter plots were used to eliminate those group item responses that did not fall within the cluster, thus indicating extreme disagreement between pairs of groups considered.

In Figure 2, the mean item responses of group 1, the university personnel, and group 2, the industry personnel, were plotted. The 45^{o} line going through the origin shows the set of points where the university personnel and the industry

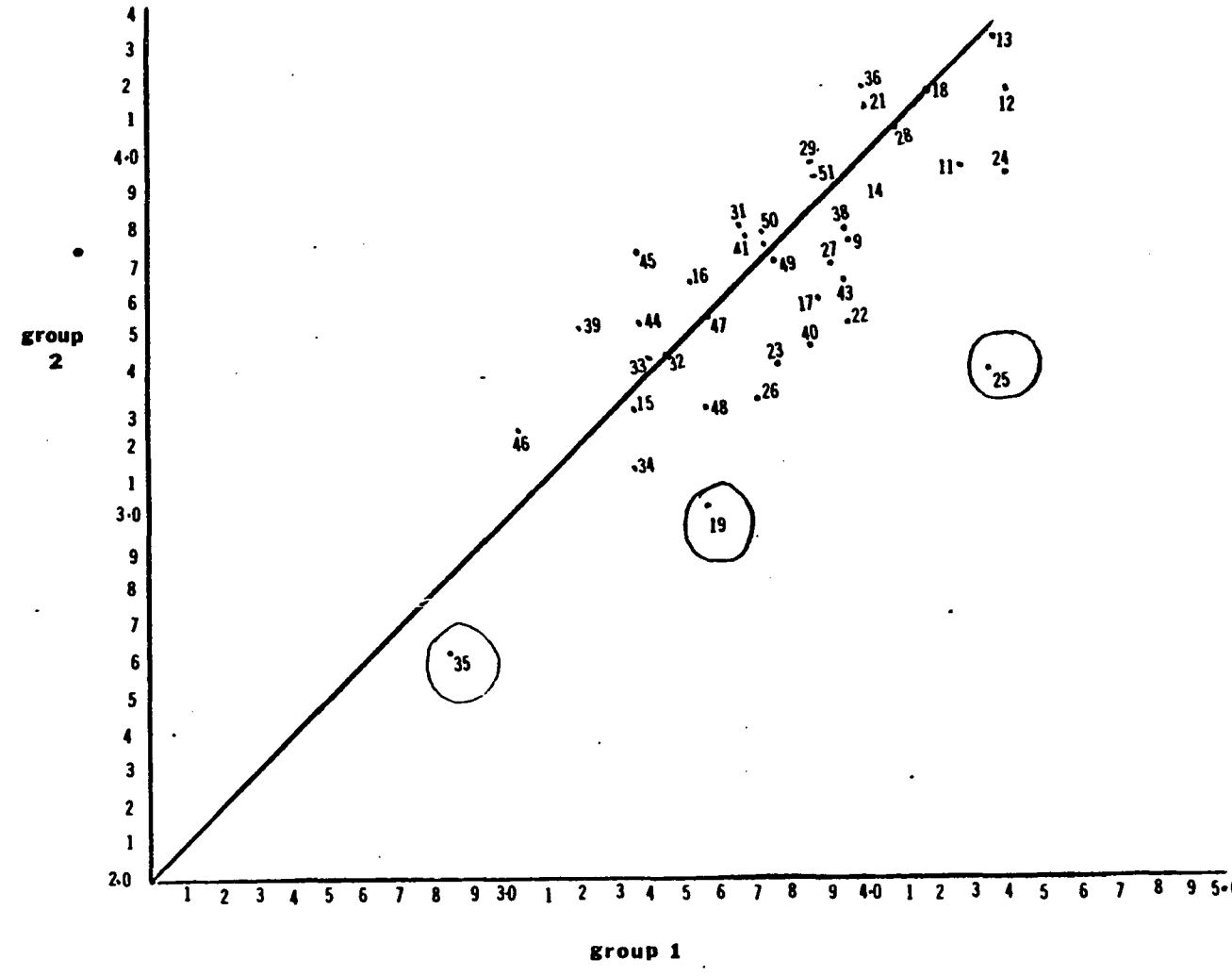

Fig. 2. Scatterplot of mean stem responses of groups 2 and 1 regarding the curriculum approaches

personnel rated the same on the variables or items in the study. Variables 32, 47, 15, and 13 were rated nearly the same by the two groups. These variables deal with selecting appropriate module or units of instruction to develop the students' skills, developing a cooperative training agreement between students, school and employers, exposing students to many occupational areas in their freshman year and providing students with experiences in problem-solving through research, creativity and concept development, respectively.

The two groups, the university personnel and the industry personnel, scored items 13, 37, 12, 28, 21, and 36 highest among the items listed under question 1 of the study. These items are as follows:

13. Providing students with experiences in problem-solving through research, creativity and concept development (group 1, $\bar{X}$ = 4.07; group 2, $\bar{X}$ = 4.31).

37. Familiarizing students with maintenance and repairs of sophisticated equipment in order that they can handle technical equipment themselves (group 1, $\bar{X}$ = 4.07; group 2, $\bar{X}$ = 4.33).

12. Including contents in the industrial technology programs that are based on industrial procedures and problems (group 1, $\bar{X}$ = 4.40; group 2, $\bar{X}$ = 4.18).

28. Emphasizing skills and technical knowledge in the programs rather than just broad general understanding (group 1, $\bar{X}$ = 4.10; group 2, $\bar{X}$ = 4.07).

21. The determination of occupational programs through cooperation among the National Universities Council, education planners, industry and labor (group 1, $\bar{X}$ = 4.00; group 2, $\bar{X}$ = 4.11).

36. Teaching the trainees how to work in modern enterprises with punctuality, regularity and efficiency (group 1, $\bar{X}$ = 4.00; group 2, $\bar{X}$ = 4.16).

The scatterplot of the mean item responses of the university personnel and the industry personnel (Figure 2) also shows that items 25, 19, and 35 did not fall within the cluster, thus indicating extreme disagreement between the two groups. The three items or variables were therefore eliminated from the list of variables to be considered for emphasis in the industrial technology programs.

In Figure 3, the scatterplot of the mean item responses of group 1 and group 3, that is, the university personnel and the industry personnel, indicates that variables 46, 35, and 20 did not fall within the cluster and therefore were eliminated. However, the two groups rated items 30, 29, 36, 42, and 25 similarly. The scatterplot also indicates that the university personnel and the industry personnel perceive items 25, 12, 13, 11, 21, 37, 18, 42, and 10 to be highly important. Items 45, 39, 32, and 34 were considered by the two groups as moderately or somewhat important.

The university personnel and the students seemed to respond similarly to all the variables. Figure 4 shows the scatterplot of item responses of the two groups. An examination of the clustering of the items indicates that those items rated high were common to both groups and those that earned low ratings were low for both groups. However, the two groups

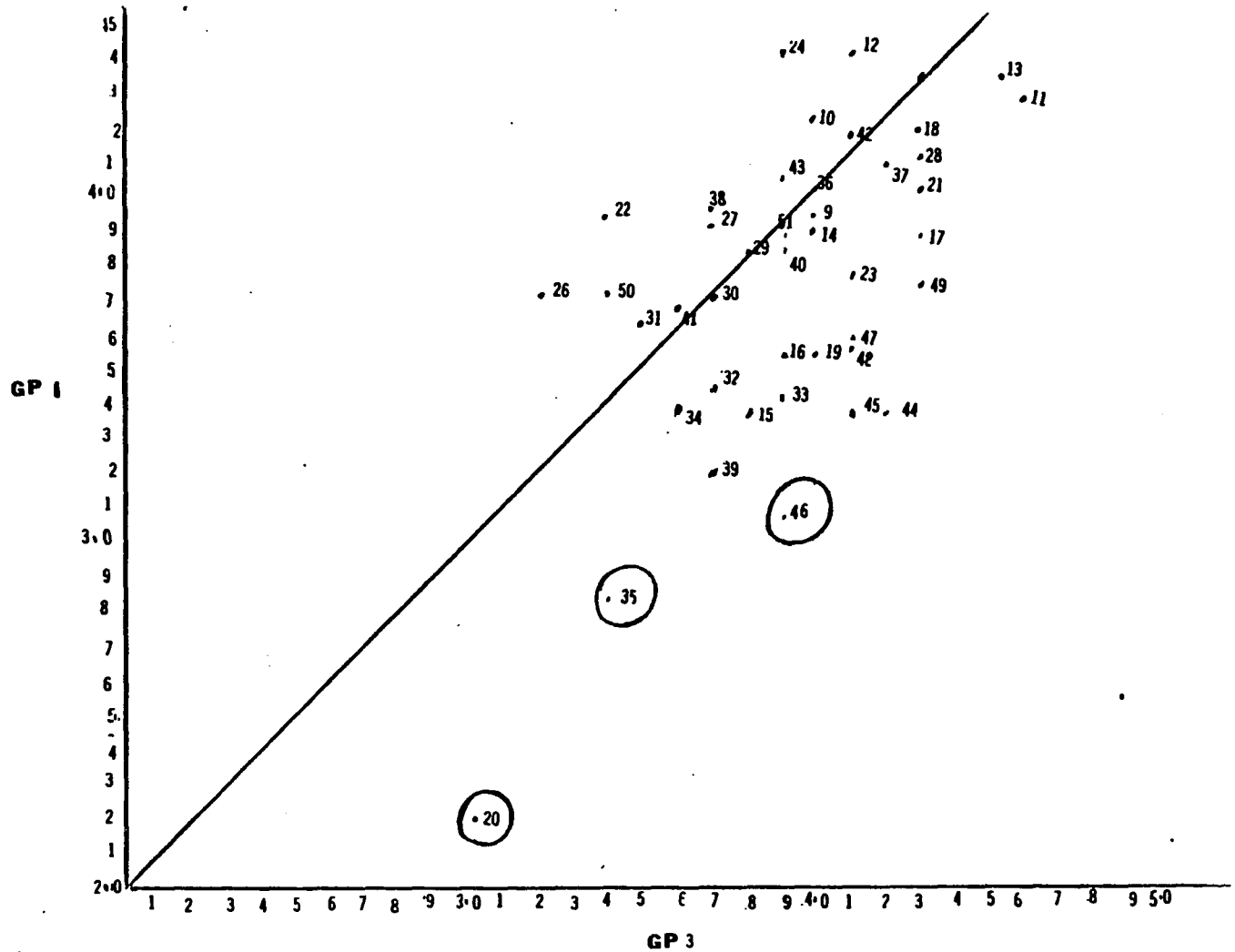

Fig. 3. Scatterplot of the mean item responses of groups 1 and 3 regarding the curriculum approaches

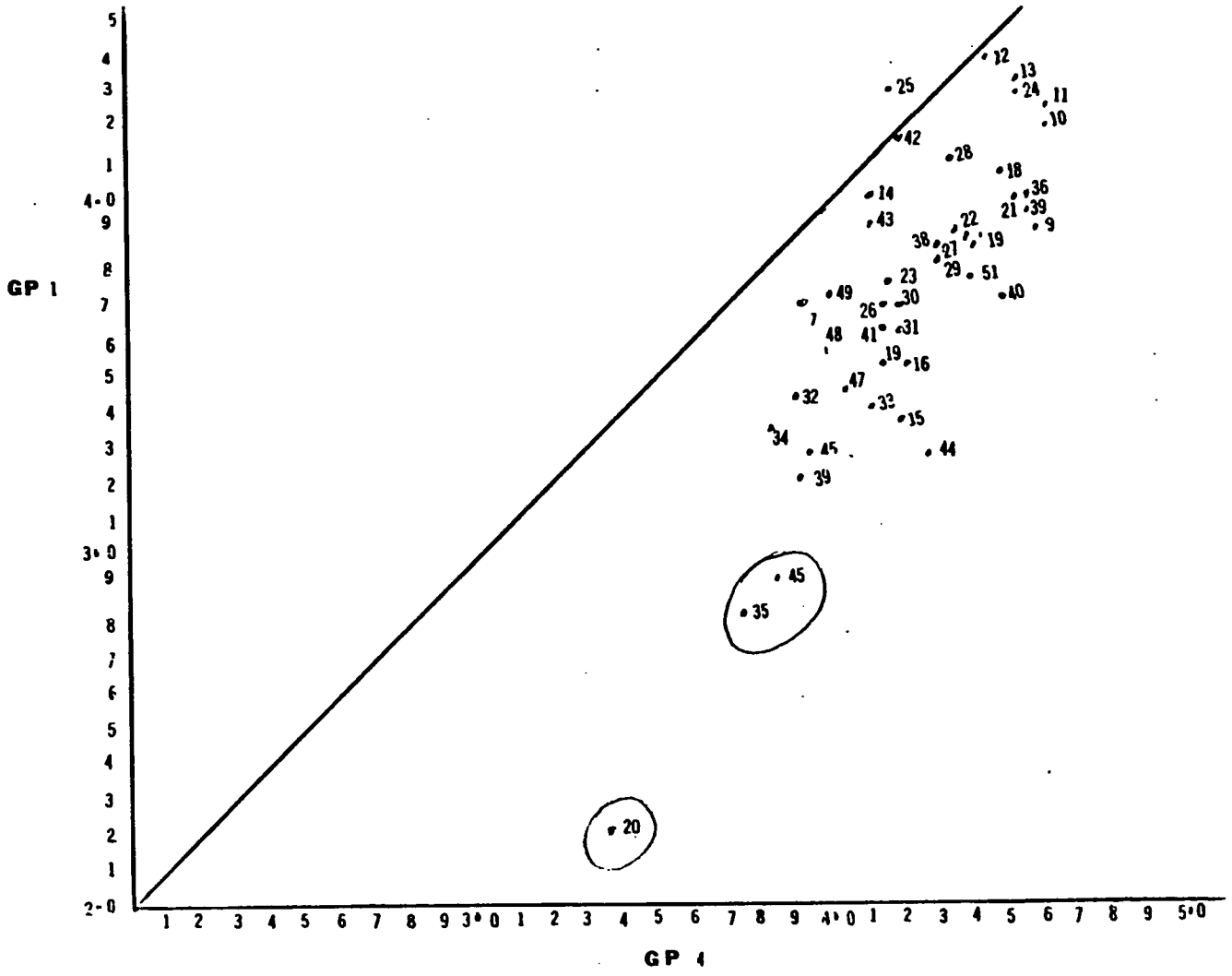

Fig. 4. Scatterplot of the mean item responses of groups 1 and 4 regarding the curriculum approaches

showed significant differences in their responses to items 20, 35, and 46, hence these items did not cluster with the rest of the items considered and therefore were eliminated. These three items were already eliminated as shown in Figure 3. This shows similarity among the university personnel, the industry personnel and the students in their response to the variables. Figure 4 also indicates that the ratings of the university personnel and the students cluster high on items 12, 13, 24, 11, and 10.

The mean item responses of group 2, the industry personnel, and group 3, the technical education administrators, were compared using a scatterplot in Figure 5. Except for items 20 and 35, which showed extreme deviation from the cluster, the two groups seemed to respond similarly to the variables. The two variables, 20 and 35, were eliminated previously in the analysis, based on extreme deviation from the cluster. While items 13, 37, 18, 21, 11, 28, 36, and 12 clustered high, items 26, 34, 15, 32, and 39 received relatively low ratings by the two groups.

The mean item responses for group 4, the industrial technology students, and group 2, the industry personnel, are presented in Figure 6. The clustering of the items indicates that those items that earned high ratings were high for both groups, while those that yielded low group ratings were low for both groups. However, close examination of the clustering

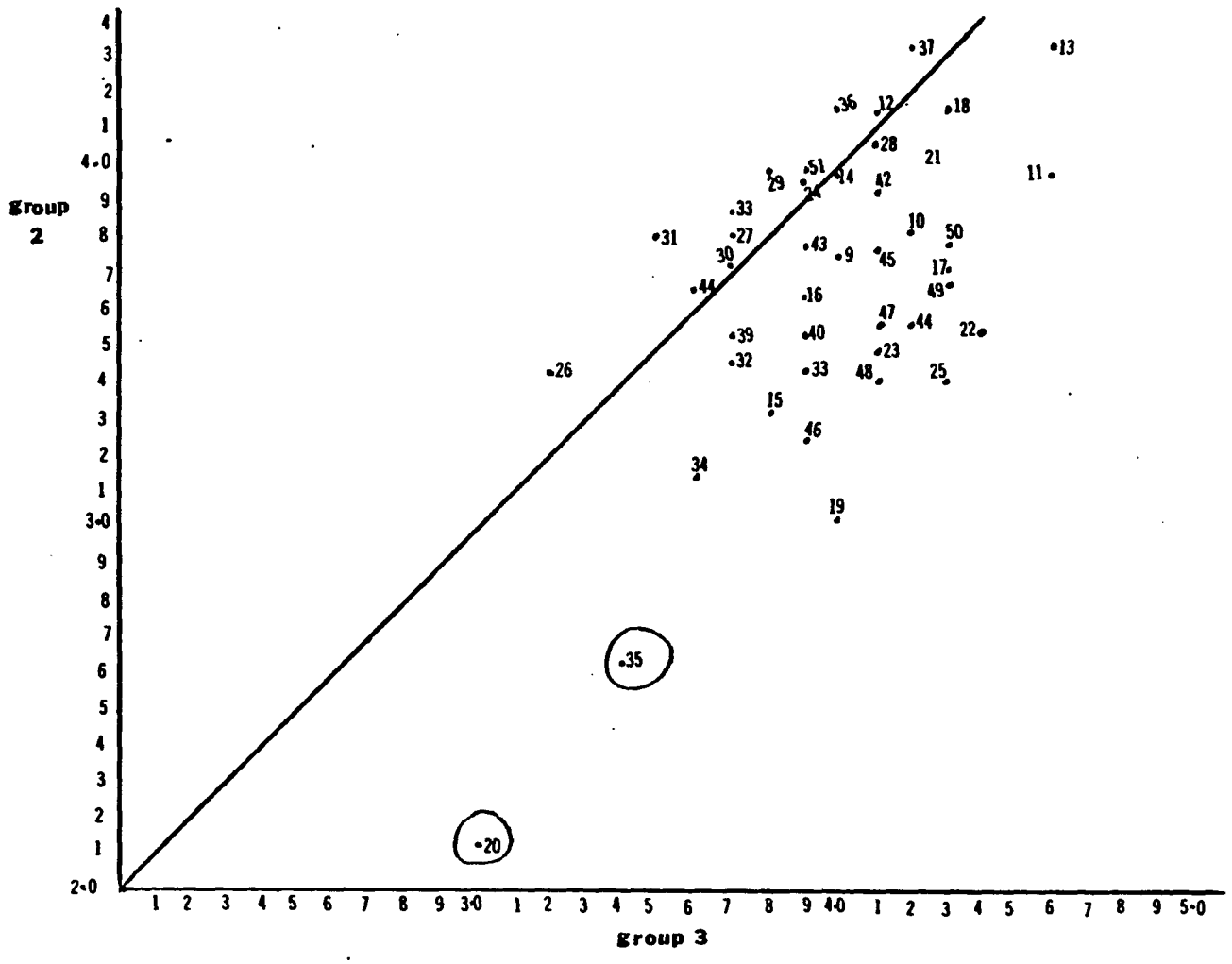

Fig. 5. Scatterplot of the mean item responses of groups 2 and 3 regarding the curriculum approaches

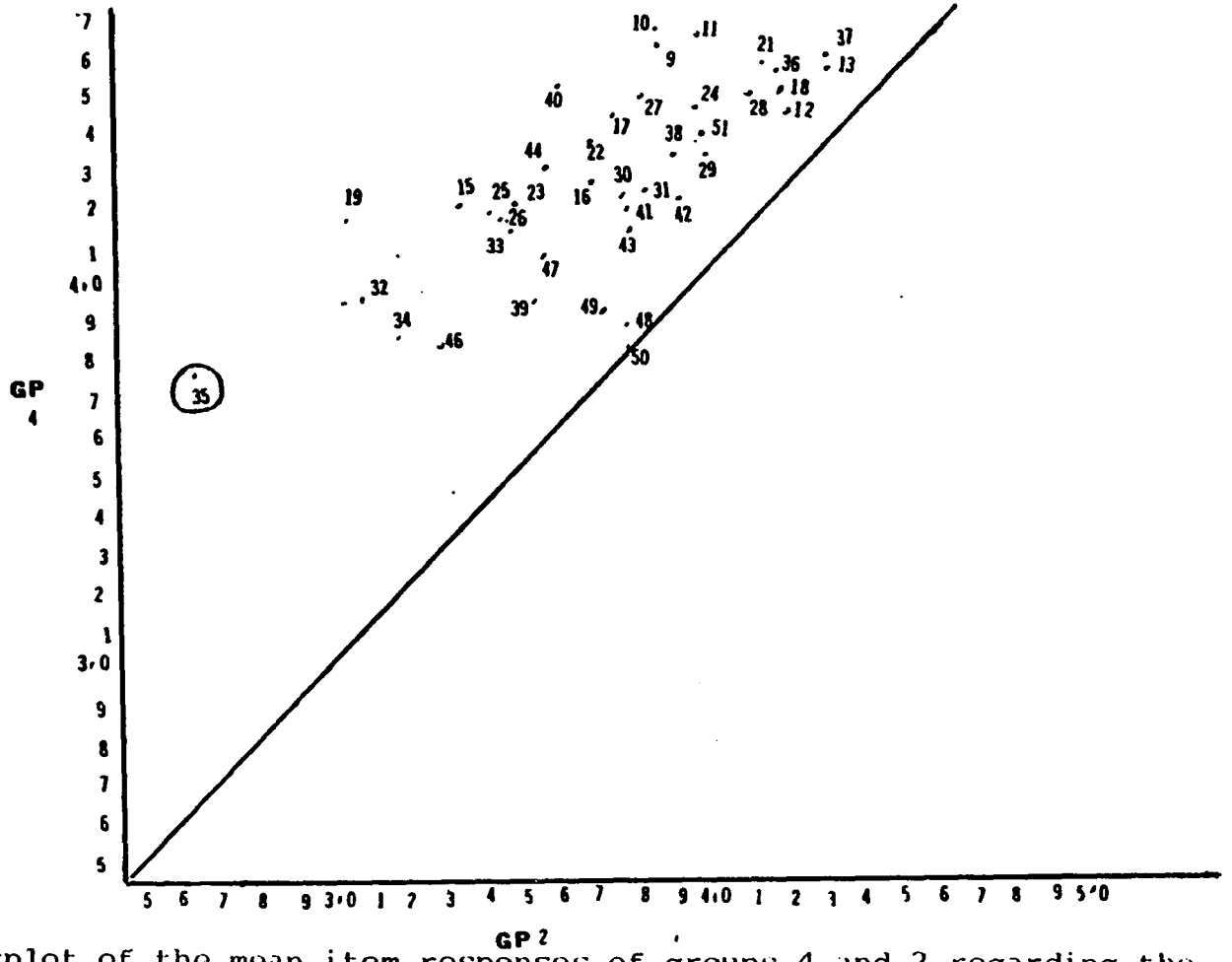

Fig. 6. Scatterplot of the mean item responses of groups 4 and 2 regarding the curriculum approaches

of the items revealed that the student group considered most of the variables as highly important. For instance, only three items (items 35, 34, and 46) received ratings below 3.9 by the students. The rest of the items received ratings above 3.9. This accounted for the tilting of the item cluster towards the X-axis representing the student group.

Figure 6 also shows that, while the ratings of the student group and the industry personnel group cluster high on items 13, 37, 21, 36, 18, 12, and 28, item 35 received the lowest rating from both groups. It also was found that item 35 did not cluster with the rest of the items and therefore was eliminated as before.

Finally, the responses of group 3, the technical educator administrators, and group 4, the students, were compared as shown by the scatterplot in Figure 7. Again, the students considered more variables as important than the technical education administrators, as shown by the ratings of the items by the two groups. The scatterplot shows that only nine variables were rated higher by the technical education administrators, while the rest (34 variables) were rated higher by the students.

Figure 7 also shows that variables 11, 13, 22, 17, 18, 21, and 10 clustered high in the scatterplot. Variables 26, 20, and 35 were more remote from the general cluster distribution, and so these items were eliminated.

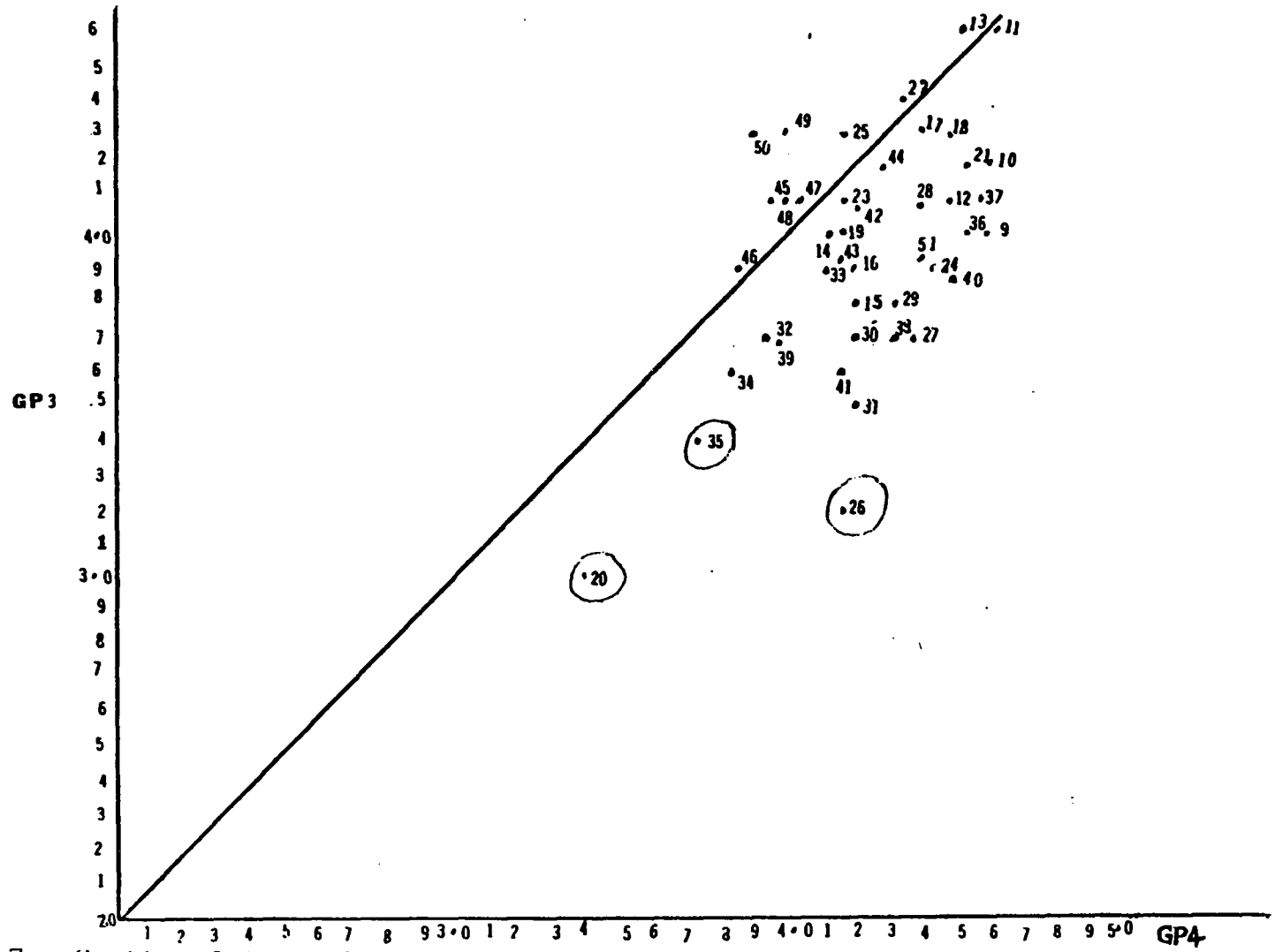

Fig. 7. Scatterplot of the mean item responses of groups 3 and 4 in relation to the curriculum approaches

It can be noted that a total of seven variables were eliminated on the basis of persistent deviation from clustering with the rest of the variables upon comparing the four groups of respondents in six combinations. The seven variables that were eliminated and which were not considered for emphasis in the industrial technology programs were the following items:

19. Surveying various occupations occasionally to determine trends that might affect job requirements and conditions in the future.

20. Giving the students the opportunity to participate in the planning of course content.

25. Involving students in problem-solving situations which involve meaningful application of other college subjects.

26. Familiarizing students with problems found in industry and employment by organizing small companies, operating with personnel, manufacturing and marketing systems (Enterprise method).

35. Establishing a list of resource people in the community along with community resources that can be utilized in the instructional programs.

44. Providing students resource materials on occupational opportunities.

46. Maintaining a liaison with federal, state and local employment agencies.

Final judgment on the curriculum approaches to be emphasized in the industrial technology programs

Based on the clustering of the mean item responses of the four groups of respondents, seven variables were found to generate discriminating responses from the sample of the

participants of the study. With the elimination of the seven variables, a total of 36 variables were left to be considered for emphasis in the industrial technology programs.

In order to make a final judgment about which of the 36 variables to be emphasized based on the specific ratings of the four groups studied, the overall means of the four groups of respondents were considered.

The overall group means for the 36 variables were plotted on a graph. Figure 8 shows the overall group means for the 36 variables under consideration.

Since the problem of the study, as addressed by question 1, focused on the curriculum approaches to be emphasized in the industrial technology programs, only those items that earned a cumulative rating of 3.99 and above were identified. The cut-off point was set at 3.99, a minimum criterion, on the graph. This means that only those variables that were rated by the four groups as highly important and above were identified for emphasis in the industrial technology programs. Nineteen variables emerged as the variables that should be emphasized as shown in Figure 8.

The nineteen variables were further grouped under four curriculum approaches and listed in descending order of importance as follows (the numbers in parentheses represent the item number in the questionnaire):

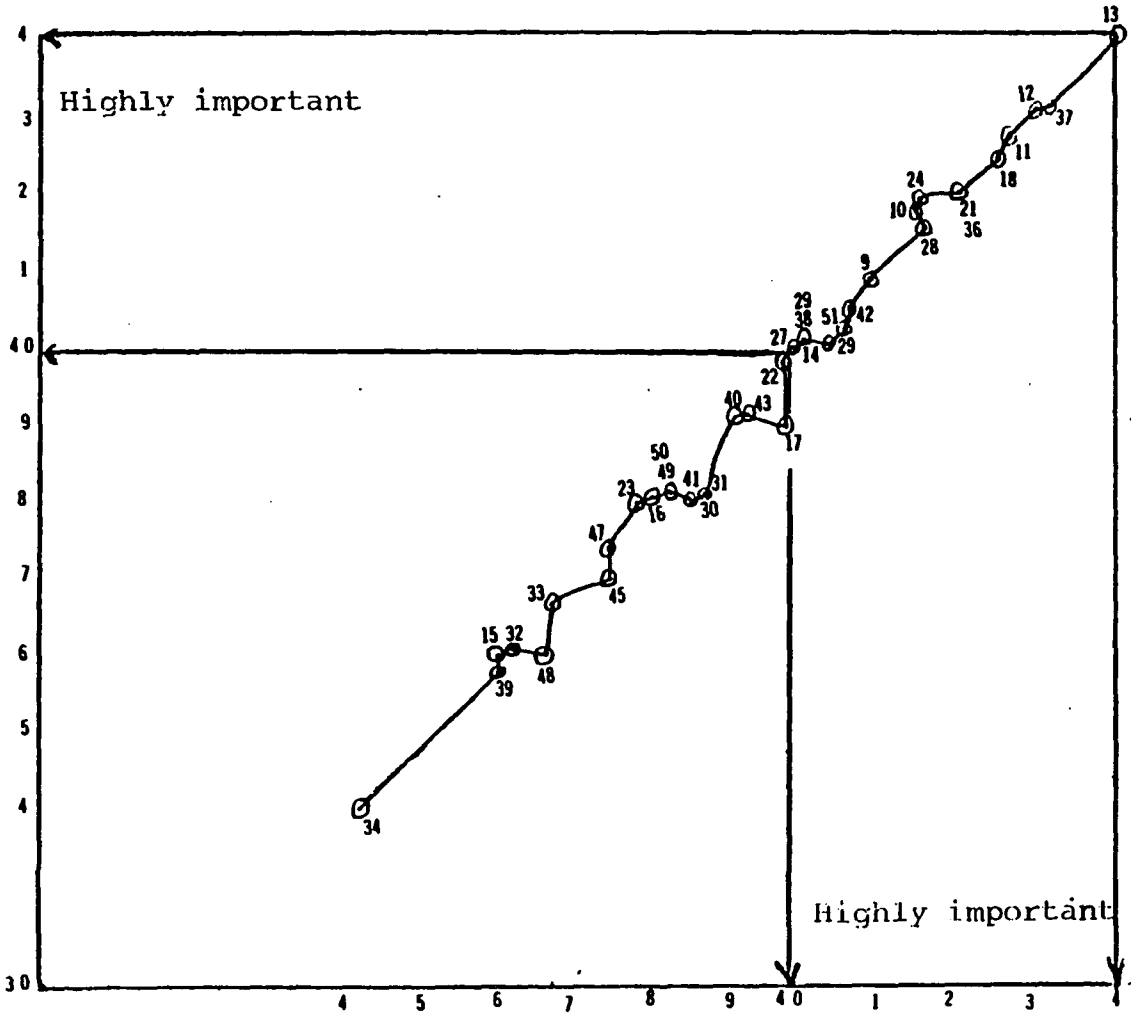

Fig. 8. Scatterplot of the overall group means for the items related to the curriculum approaches

A. Research/philosophical approach:

1. Providing students with experiences in problem-solving through research, creativity and concept development with basic tools and requirements fundamental to all industries or occupations (13).

2. Familiarizing students with maintenance and repairs of sophisticated equipment so that they can later handle technical equipment themselves (37).

3. Providing instructions and learning activities and experiences in several occupational areas to reveal students' talents in technological and scientific fields, industry requirements and natural needs (11).

4. Providing students with research and problem-solving activities to enable them to acquire skills in the process of acquiring knowledge rather than just receiving it (18).

5. Teaching the trainees how to work in modern enterprises with punctuality, regularity and efficiency (36).

6. Providing opportunities for students to learn industrial processes and production through building projects that stimulate visual, mental, and physical capabilities (24).

7. Emphasizing skills and technical knowledge in the programs rather than just broad general understanding (28).

8. Teaching trade skills that could ultimately lead to gainful employment (29).

B. Strategic planning approach:

9. The industrial technology programs should be based on the economic trends, manpower needs and students' interests (22).

C. Occupational guidance approach:

10. Including contents in the industrial technology programs that are based on industrial procedures and problems, thus giving students a realistic picture of conditions prevailing in the world of work (12).

11. Teaching students to understand the effects of technological advances on production of goods and services in industry (10).

12. Teaching students to understand how technological advances have changed the lives of people and to consider future conditions which may affect them (9).

13. Establishing public relations activities to educate the Nigerian public in the potential of industrial technology in the economic development of Nigeria (51).

14. Organizing field trips to industries to help students improve their knowledge of industry, working conditions and work atmosphere (14).

15. Training students for various job possibilities through emphasis on multitechnical skills and transfer of training so that they are always ready to adjust to new situations (38).

16. Familiarizing the students with the problems and prospects of industry and Nigerian society in order to motivate students to further their education (17).

D. Cooperative approach:

17. Occupational programs should be determined through cooperation among the National Universities Council, education planners, industry and labor in order to meet the social and economic needs of Nigeris (21).

18. Organizing conferences and seminars with employers in order to keep abreast of technological developments and also improve on-the-job instructions (42).

19. Encouraging students to read and interpret drawings and blueprints in industry (27).

It is worth mentioning that the other variables that earned lower ratings could still be employed in the industrial technology programs in order that students adjust to technological changes in the occupational requirements of the work

force. What is actually implied here is that the above listed approaches should receive greater emphasis in the industrial programs in the Nigerian Federal Universities of Technology.

Findings Regarding the Occupational Areas to be Emphasized in the Industrial Technology Program Planning in Response to National Manpower Demands, Students' Needs and Requirements of Industry

Apart from some significant differences found between group 4 and group 2, the students and the industry personnel, respectively, there was a measure of agreement among the four groups with respect to the occupational areas that should be emphasized in the planning of industrial technology programs. There was agreement on nine variables and significant differences on 12 variables among the groups, especially between groups 2 and 4, as indicated by the analysis of variance.

Table 24 shows areas of significant differences at 0.01 and 0.05 levels, while Table 25 shows areas of agreement among the four groups of respondents.

It should be noted that the differences among the four groups, as indicated in Table 24, were in the central tendency since the groups were tested for differences in means, under the analysis of variance. The differences were not necessarily in the range of scores (variability) among the groups.

Table 24. Mean, standard deviation and analysis of variance showing areas of significant differences among groups in relation to the occupational areas to be emphasized in the industrial technology programs

Occupational areas[a]	Overall mean	Std. dev.	F-value
1. Health occupations (68)	4.45	0.72	3.05**
2. Scientific and technical occupations: conservation engineering, environmental science, life sciences, mathematics, physical sciences (65)	4.45	0.79	3.61**
3. Electronics (70)	4.38	0.75	7.75**
4. Metal machining occupation (52)	4.35	0.84	5.39**
5. Other scientific and technical occupations: broadcasting technology, drafting, engineering, and science technology/technicians, surveyors, etc. (66)	4.29	0.79	6.43**
6. Fabricating and assembling occupations (metal products, construction) (59)	4.26	0.90	4.62
7. Construction occupation (69)	4.24	0.85	3.85*
8. Foundry occupations (pattern making, molding, core making) (62)	4.02	1.01	7.94**
9. Fabricating, assembling and repairing occupations (wood products) (61)	3.88	0.97	10.30**
10. Graphics (71)	3.88	0.94	8.89**

[a]Numbers in parentheses represent item numbers in the questionnaire.

*,**Significant at 0.05 and 0.01 levels, respectively.

Table 24. (Continued)

Occupational areas	Overall mean	Std. dev.	F-value
11. Wood machining occupations (54)	3.83	1.00	10.10**
12. Printing occupations (63)	3.70	1.02	4.57**

Table 25. Mean, standard deviation, and analysis of variance showing areas of consensus (no significant differences) among groups in relation to the occupational areas to be emphasized in the industrial technology programs

Occupational areas[a]	Overall mean	Std. dev.	F-value
1. Processing occupations: mineral, metal, clay, glass, stong, plastic, wood, chemicals (58)	4.44	0.72	0.37
2. Mining and quarrying including oil and gas fields occupations (57)	4.37	0.82	1.14
3. Metal shaping and forming occupations (53)	4.34	0.90	4.08
4. Fabricating, assembling, installing and repairing occupations (plastics) (60)	4.26	0.84	2.68
5. Mechanics and repairmen (67)	4.15	0.90	2.22
6. Office occupations: clerical, banking, administration/management, computer programming (64)	4.03	0.95	2.02

[a]Numbers in parentheses represent item numbers in the questionnaire.

Table 25. (Continued)

Occupational areas	Overall mean	Std. dev.	F-value
7. Other machining and related occupations: engraving, filling, grinding, buffing, cleaning and polishing, patternmaking and molding, inspecting and testing occupations (56)	3.90	0.96	1.77
8. Clay, glass, stone and related material machining occupations (55)	3.72	0.99	1.60
9. Other occupations	1.88	1.59	2.43

Tables 24 and 25 indicate that the occupational areas that received the highest rating as evidenced by the overall means were scientific and technical occupations including conservation engineering, environmental sciences, life sciences, mathematics and physical sciences ($\bar{X}$ = 4.45), health occupations ($\bar{X}$ = 4.45), processing occupations ($\bar{X}$ = 4.44), electronics ($\bar{X}$ = 4.38), mining and quarrying occupations (oil, gas field occupations) ($\bar{X}$ = 4.37).

The occupational areas that earned relatively lower ratings included printing occupations ($\bar{X}$ = 3.70), clay, glass, and related machining occupations ($\bar{X}$ = 3.72), wood machining occupations ($\bar{X}$ = 3.83), and graphics ($\bar{X}$ = 3.88).

Occupational areas to be emphasized in the industrial technology programs

In order to identify the occupational areas to be emphasized in the industrial technology programs based on the ratings of the four groups, the mean item responses of the groups were plotted on a scatterplot. The mean item responses for the four groups were compared in six combinations in order to eliminate those items that fell outside the clusters.

In Figure 9, the mean item responses by the university personnel and industrial personnel were plotted. The two groups responded to the items related to questions 2 and 3 of the study regarding the occupational areas and evaluation components to be emphasized in the industrial technology programs. In Figure 9, the 45^{o} line going through the origin represents the set of points where the university personnel and the industry personnel rated similarly on specific variables.

Figure 9 also shows that both the university personnel and the industry personnel rated the variables similarly and that most variables were rated higher by the university personnel than the industry personnel. All the items fell within the cluster.

In Figure 10, in which the mean item responses of the university personnel and the technical education administrators were compared, there seems to be an even distribution of the responses by the two groups. However, all the items are clustered, indicating a similarity in the responses by the

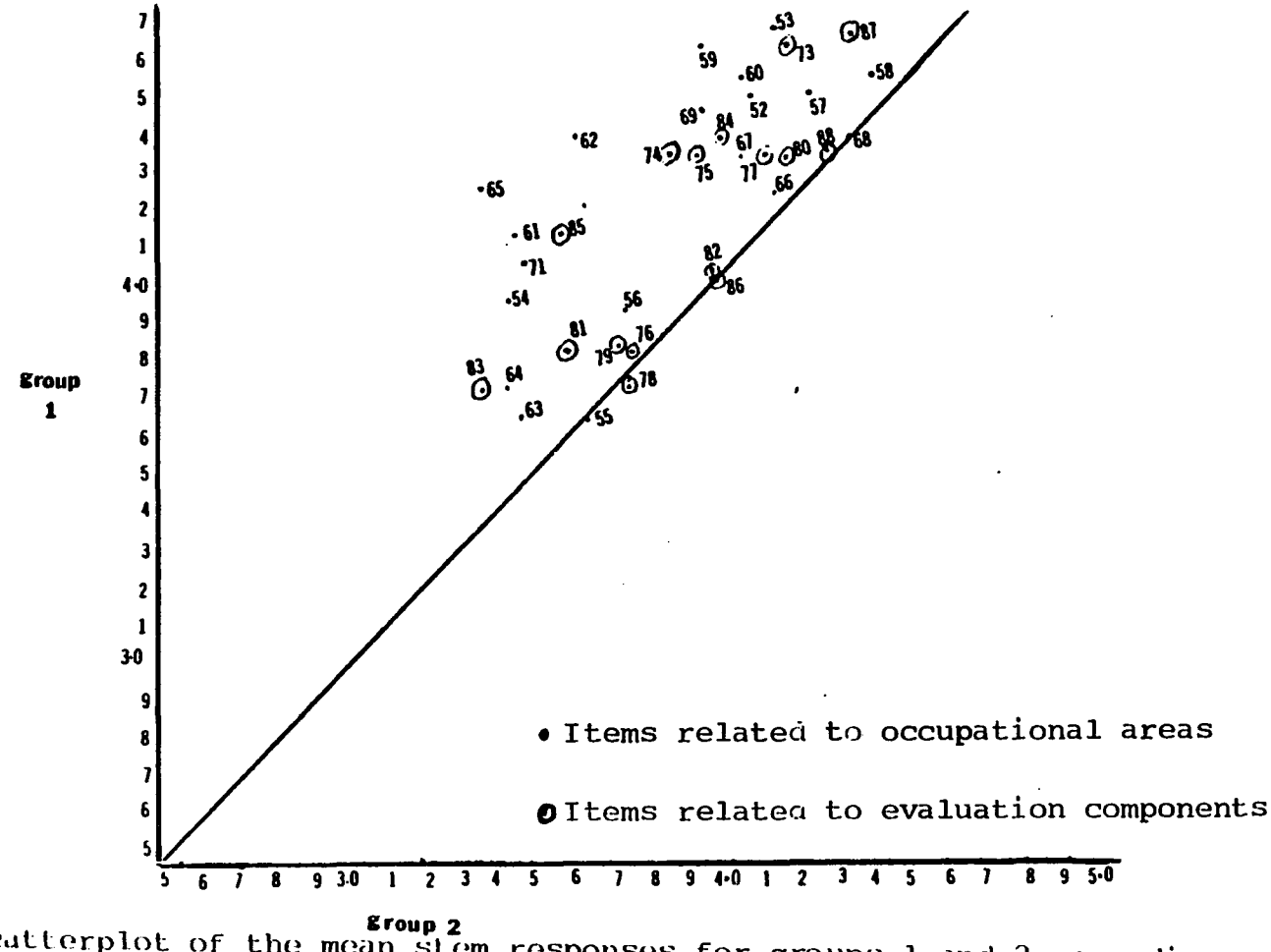

Fig. 9. Scatterplot of the mean stem responses for groups 1 and 2 regarding the occupational areas and evaluation components

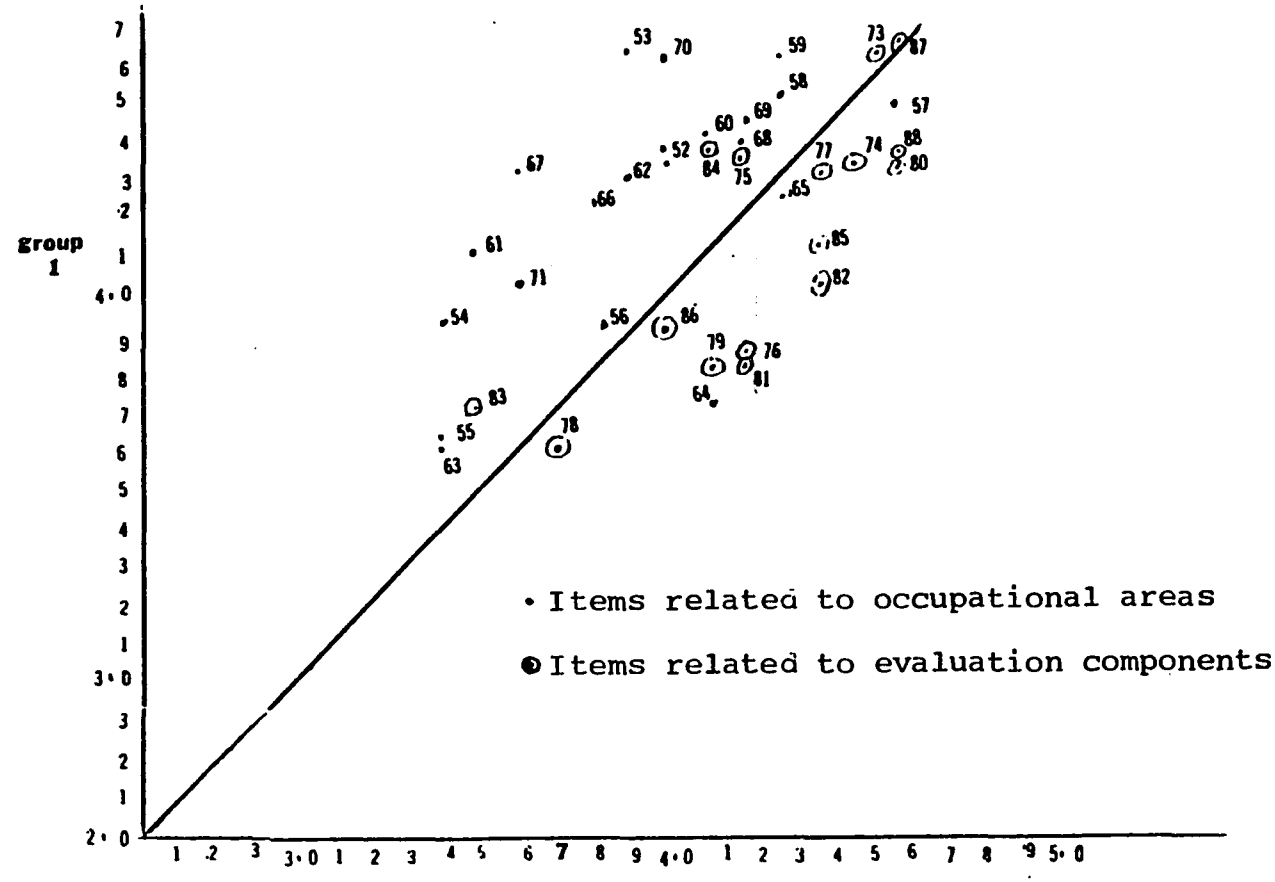

Fig. 10. Scatterplot of the mean item responses for groups 1 and 3 in relation to the occupational areas and evaluation components

two groups.

The scatterplot in Figure 11 indicates that almost all the items were rated high (4.0 and above) by the student group. The items are clustered, indicating a measure of agreement between the university personnel and the students.

Figure 12 shows a more dispersed cluster of the items for groups 2 and 3, that is, the industry personnel and the technical education administrators. The scatterplot indicates that the two groups perceived items 87, 88, 57, 58, and 65 to be highly important, while they perceived items 63, 54, 61, 83, 71, and 55 as moderately important. However, all the items were considered to be distributed within the cluster showing that the two groups responded similarly to the variables.

Comparing the mean item responses of the industry personnel and the students, it was observed that the students rated all the items as highly important while the industry personnel perceived 13 items as moderately important and 23 items as highly important. Figure 13 shows the scatterplot of the mean item responses of the industry personnel and the students.

Finally, the mean item responses by the technical education administrators and the students were plotted as presented in Figure 14. A majority of the variables were rated high by group 3, the technical education administrators, while the

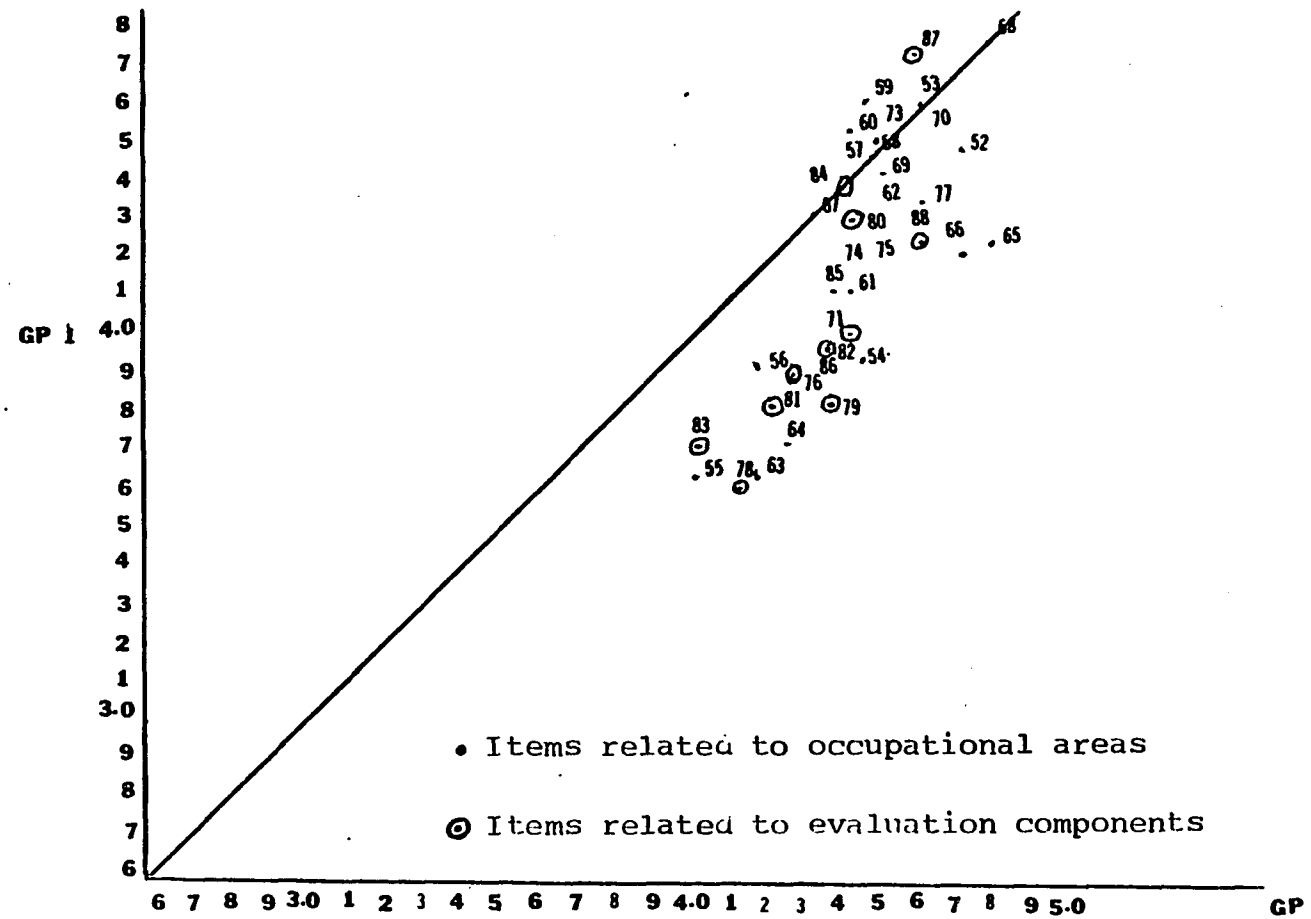

Fig. 11. Scatterplot of the mean item responses for groups 1 and 4 in relation to occupational areas and evaluation components

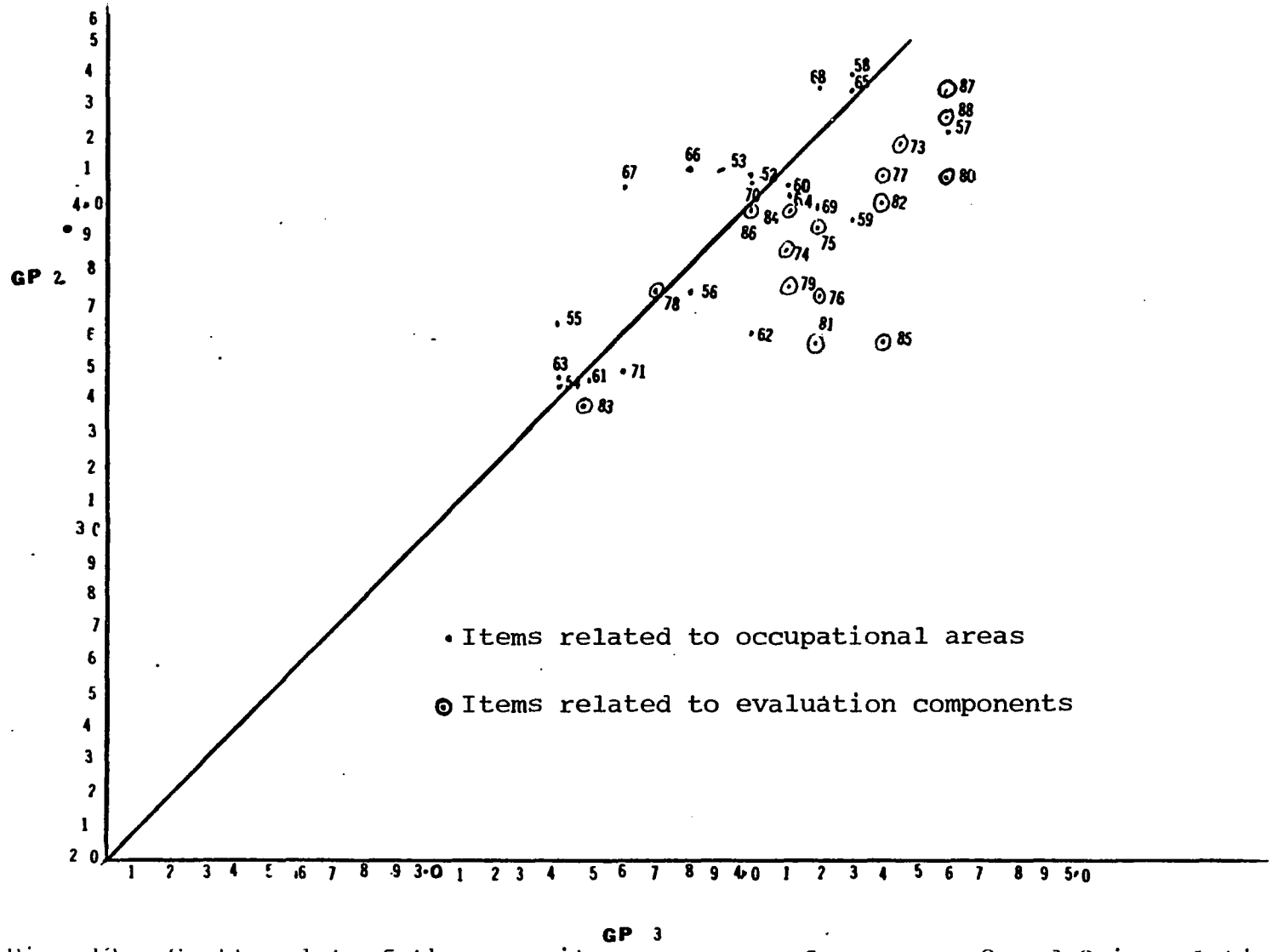

Fig. 12. Scatterplot of the mean item responses for groups 2 and 3 in relation to the occupational areas and evaluation components

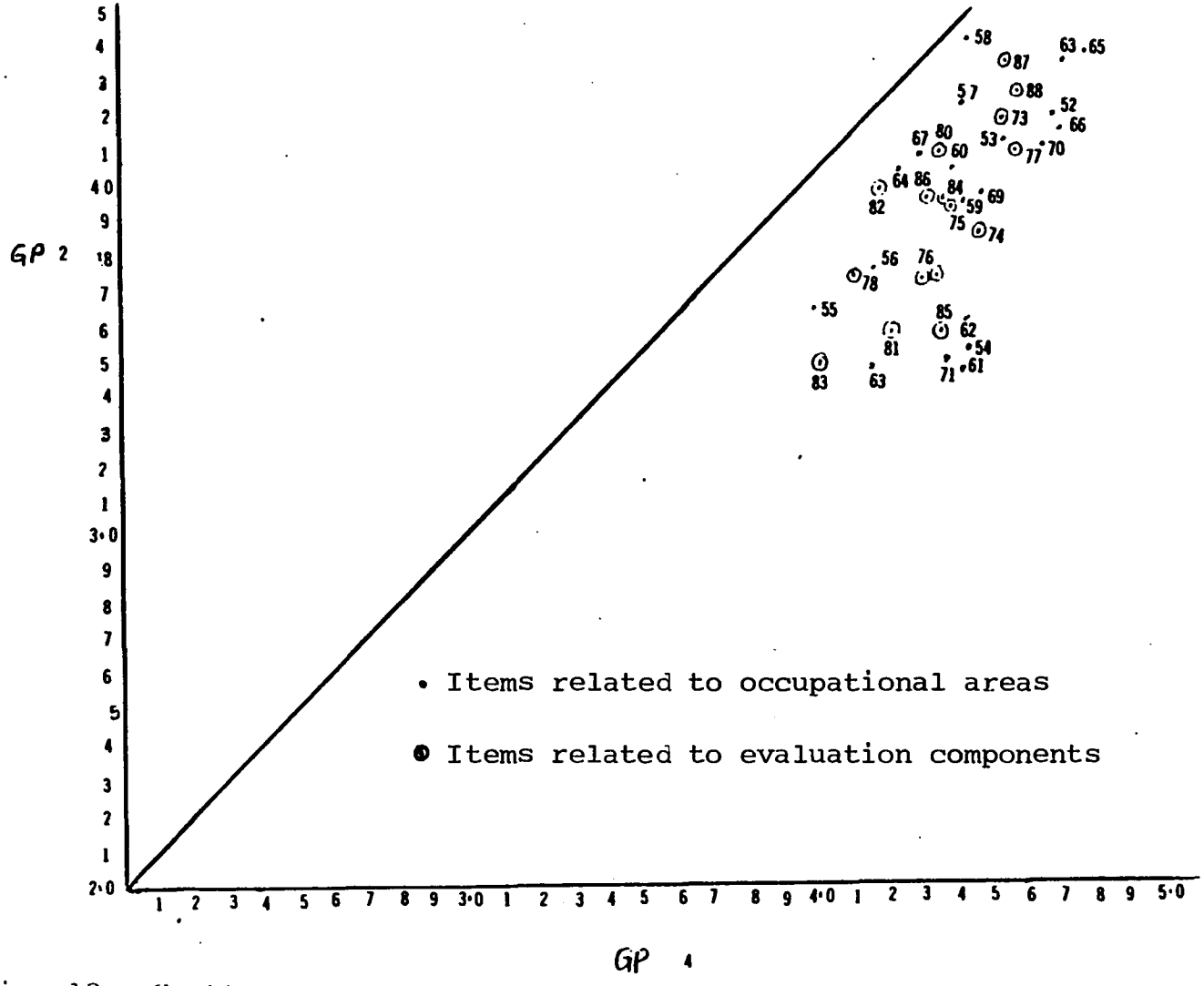

Fig. 13. Scatterplot of the mean item responses of groups 2 and 4 in relation to the occupational areas and evaluation components

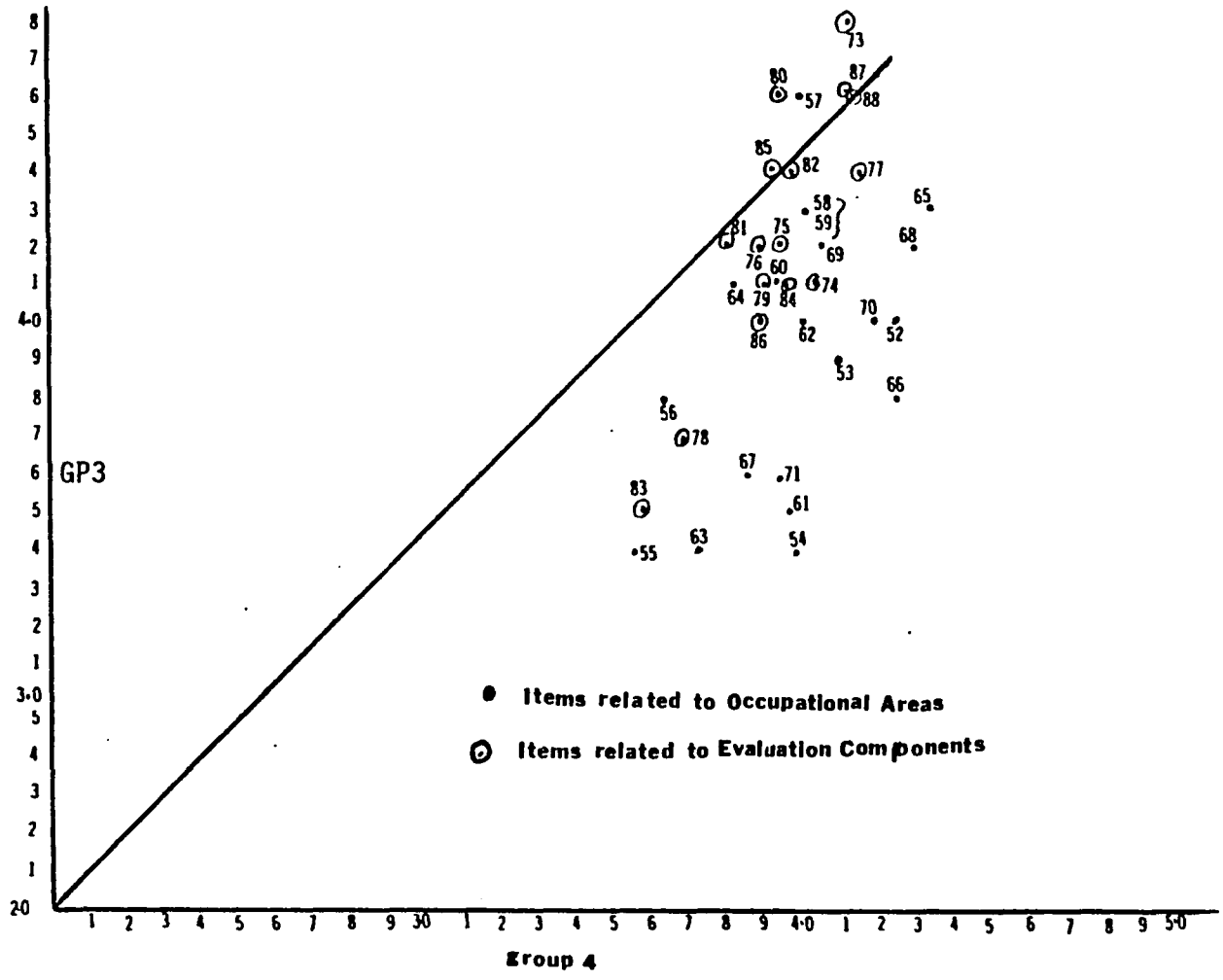

Fig. 14. Scatterplot of the mean item responses of groups 3 and 4 in relation to the occupational areas and evaluation components

students rated all the variables 4.0 and above.

Final judgment regarding the occupational areas to be emphasized in the industrial technology programs

Based on the scatterplot analysis, there seemed to be a considerable measure of agreement among the four groups of respondents as indicated by the clustering of all the items shown in Figures 9, 10, 11, 12, 13, and 14. All the items or variables related to question 2 of the study regarding the occupational areas to be emphasized in the industrial technology programs were considered in the final judgment.

In order to make the final judgment regarding the occupational areas to be emphasized, based on the specific ratings of the four groups studied, the overall means of the groups were considered.

The overall means of the responses of the four groups on 36 variables were plotted on a graph, as shown in Figure 15.

Using 3.99 as the cut-off point, 14 occupational areas emerged as areas to be emphasized in the industrial technology programs. Health occupations were rated highest while printing occupations and wood machining occupations received the lowest rating.

The occupational areas identified for emphasis are listed in descending order of importance as follows:

1. Health occupations
2. Scientific and technical occupations (conservation,

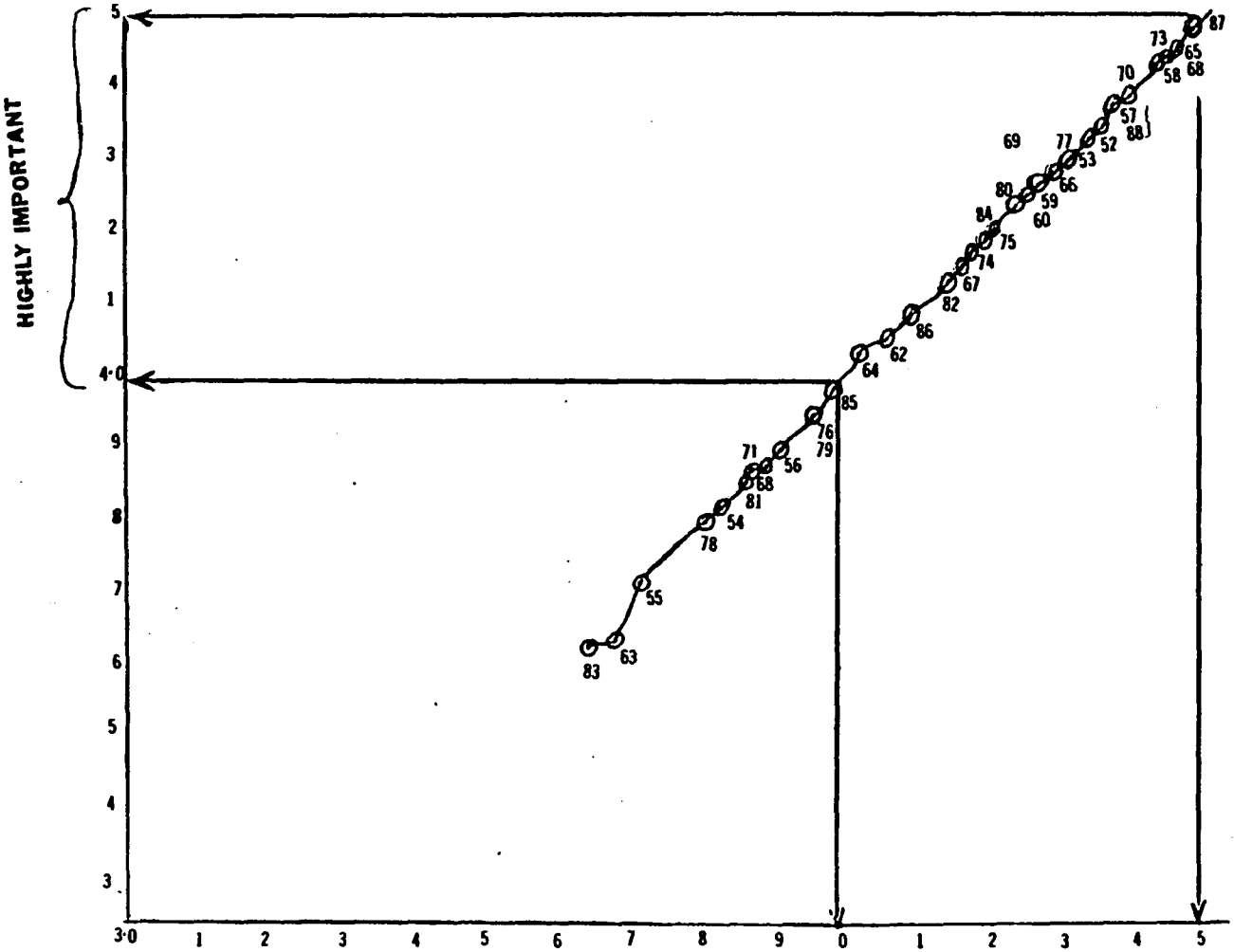

Fig. 15. Scatterplot of the overall group means for the items related to the occupational areas and evaluation components

engineers, environmental scientists, life scientists, mathematics, physical scientists)

3. Processing occupations: mineral, metal, clay, glass, stone, plastic, wood, chemicals, etc.

4. Electronics

5. Mining and quarrying including oil and gas field occupations

6. Metal machining occupations

7. Metal shaping and forming occupations

8. Other scientific and technical occupations (broadcast technicians, drafters, engineering and science technologists/technicians, surveyors, etc.)

9. Fabricating and assembling occupations (metal products, construction)

10. Fabricating, assembling, installing and repairing occupations (plastics)

1. Construction occupations

12. Mechanics and repairmen

13. Office occupations: clerical, banking, administration, computer programmers, etc.

14. Foundry occupations (pattern makers, molders, core makers)

The following areas received relatively low ratings:

1. Printing occupations

2. Wood machining occupations

3. Fabricating, assembling and repairing of wood products

4. Other machining and related occupations: engravers, filling, grinding, buffing, cleaning and polishing etc.

5. Clay, glass, stone and related materials machining occupations

Need for occupational clustering

Until a generation ago, it was the common practice for the curriculum planners in vocational education to develop programs geared towards training people for single occupations. Technological changes affect occupations and workers with the result that those people trained in single occupations need to be retrained in response to these changes.

Today, the trend is towards training people with skills, knowledges and attitudes required for entry and progress into a family or cluster of occupations, thus enabling such people to quickly adjust to new situations.

The respondents surveyed in this study gave a rating of 4.00 to the item dealing with "training students for various job possibilities through emphasis on polytechnical skills and transfer of training" (Table 22). In other words, they were in favor of occupational clustering since they rated the item "highly important."

Based on the broad cluster concept, the occupational areas which have been identified for emphasis in the industrial technology programs could be grouped into seven major cluster areas, namely, construction, transportation, manufacturing, and communications, and health occupations, management, and energy.

Figure 16 shows the grouping of the occupational areas into seven main clusters.

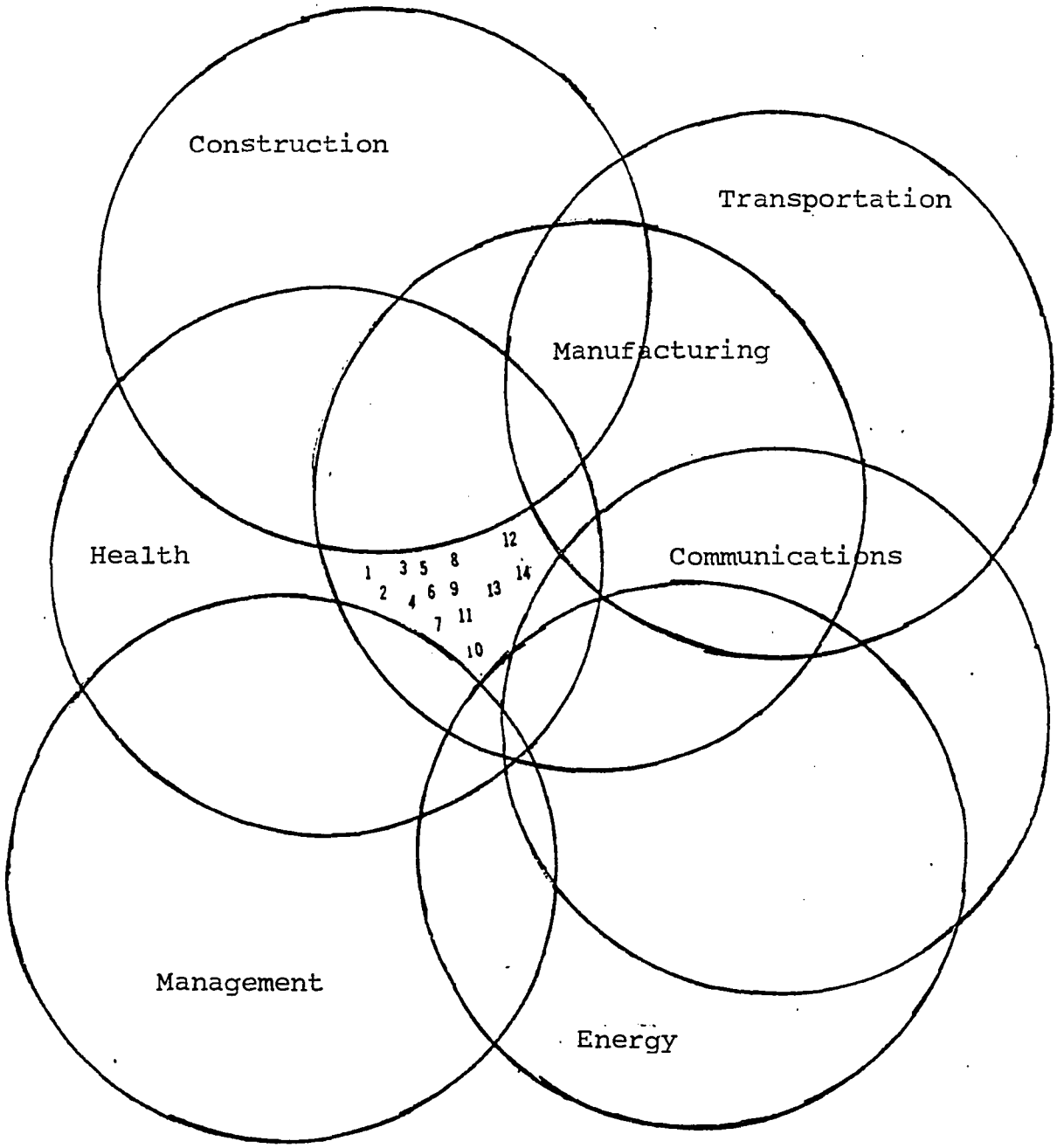

Figure 16. Occupational clustering of occupations identified in the study (the numbers represent the items listed on pages 184 and 185)

Findings Regarding the Evaluative Practices, Procedures, Processes and Guidelines that Will Contribute to the Success of the Industrial Technology Programs

In order to answer question 3 of the study, a list of evaluative practices, procedures, processes and guidelines was presented to the respondents. They were asked to rate each item to indicate the importance of its contribution to the success of program planning in industrial technology in the Nigerian Federal Universities of Technology.

Nine items emerged as areas of significant differences among the four groups, while seven areas were found to be agreed upon by the respondents as making a contribution at different levels. In other words, there was consensus among the four groups with regard to these seven variables.

Table 26 reveals the overall means, standard deviations and the analysis of variances relating to the evaluation of the industrial technology programs.

It was found that only two items received relatively low rating (less than 3.9) from the four groups of respondents. These items were (1) The promotion of faculty and support personnel should be based on the outcome of their own activities ($\bar{X}$ = 3.81) and (2) A cost-related evaluation or assessment should be undertaken by the department in collaboration with industry in relation to program attributes and outcomes ($\bar{X}$ = 3.65). The responses to these two items by each group were further considered to find out how each group reacted

Table 26. Means, standard deviations, and analyses of variances relating to the evaluation of industrial technology programs

Evaluation components[a] Areas of significant differences	Overall mean	Std. dev.	F-value
1. Industrial technology programs should be evaluated with respect to educational resources, curriculum, and facilities to determine limitations and possibilities needed to assess the extent to which they meet the goals, philosophy and objectives of the department and instruction (73)	4.44	0.74	4.20**
2. Evaluation of the programs and facilities should be carried out annually to generate data needed by the universities to determine the worth of the existing programs (74)	4.17	0.82	5.77**
3. The programs and facilities should be assessed in order to make decisions regarding the assignment of teaching personnel, support personnel and student selection (75)	4.17	0.79	3.33*
4. Annual evaluation of the program should be carried out for the department administration to make defensive decisions regarding program changes, additions or deletions (76)	3.95	0.90	4.43**
5. The department should embark on a comprehensive evaluation system in order to identify strengths and deficiencies of faculty performance, thus helping them to improve upon their performance (77)	4.31	0.76	3.69*

[a]Numbers in parentheses represent item number in the questionnaire.

*,**Significant at 0.05 and 0.01 levels, respectively.

Table 26. (Continued)

Evaluation components Areas of significant differences	Overall mean	Std. dev.	F-value
6. Faculty members should be involved in evaluation in order that they gain evaluative expertise that will help them plan and evaluate their own activities (79)	3.95	0.89	4.73**
7. The program should be evaluated to insure accountability of expenditures through the presentation of program results (81)	3.90	0.95	4.32**
8. A cost-related evaluation or assessment should be undertaken by the department in collaboration with industry, in relation to program attributes and outcomes (83)	3.65	1.03	3.17*
9. A team of external experts, internal personnel, community businesses, industry personnel and some lay citizens should be involved in reviewing the department's objectives, evaluation procedures, content, personnel and program contents and make recommendations for brining the programs closer to meeting the needs of students and the community (85)	3.99	1.16	4.44**
<u>Areas of consensus</u>			
10. The promotion of faculty and support personnel should be based on the outcome of their evaluation (78)	3.81	1.01	1.92
11. Evaluation should be used as a tool to determine program deficiencies with a view to taking correction action (80)	4.26	0.85	1.80

Table 26. (Continued)

Evaluation components Areas of consensus	Overall mean	Std. dev.	F-value
12. The teaching methods should be evaluated to insure that the range of students' learning capabilities are accommodated (82)	4.14	0.97	2.04
13. The department administration in cooperation with industry should conduct a follow-up study of graduates to determine strengths and weaknesses of their job preparation and ways to improve the program (84)	4.20	0.85	2.52
14. Utilizing a competency model developed by the department and industry, both agencies should evaluate the employees' performance on the job in order to modify the training programs when necessary (86)	4.08	0.85	1.79
15. The program should be evaluated to insure that they are consistent with the occupational needs of the country (87)	4.50	0.76	1.29
16. The department and industry should work together to develop, administer and interpret forms for on-the-job training evaluations (88)	4.37	0.82	1.75

to the items. Tables 27 and 28 show the means, standard deviations and analyses of variance by group in relation to the two items in question.

Table 27. Mean ratings, standard deviation and analysis of variance by group in relation to the degree of contribution of the promotion of university personnel based on their evaluation to the success of the industrial technology programs

Group	Mean	Std. dev.	F-ratio
1	3.60	1.07	1.92*
2	3.73	0.95	
3	3.70	0.82	
4	4.13	1.04	

*Significant at the 0.05 level.

As can be seen in Table 27, the three groups, the university personnel, the industry personnel and the technical education administrators, rated the item relatively low, indicating that the promotion of the university personnel based on the outcome of their evaluation will not contribute much to the success of the industrial technology programs. Group 4 (students) rated the item the highest (4.13) in the four groups. This meant that they saw university personnel promotion based on the outcome of their evaluation as contributing highly to the success of industrial technology

Table 28. Mean, standard deviation and analysis of variance in relation to group response to conducting a cost-related evaluation of program attributes and outcome

Group	Mean	Std. dev.	F-ratio
1	3.70	0.99	3.17*
2	3.38	1.19	
3	3.50	0.97	
4	4.03	0.68	

*Significant at the 0.05 level.

programs.

A similar result was found in the area of conducting cost-related evaluation or assessment in relation to program attributes and outcomes. While the student group considered the conducting of cost-related evaluation of program attributes and outcomes as highly important for the success of the industrial technology programs, the other three groups had different views. They did not consider such evaluation important enough as to contribute to the success of the industrial technology programs. Table 28 indicates that the university personnel rated the item 3.70, the industry personnel 3.38, and the technical education administrators 3.50.

It is interesting to note that the four groups agreed that evaluation should be used more as a tool for identifying

strengths and deficiencies of faculty performance than for the promotion of faculty and support personnel.

The differences in the ratings between the student group and the other three groups in relation to the use of evaluation for the promotion of the university staff and for the determination of program attributes and outcomes through cost-benefit analysis could be due to the differences in geographical location of the groups at the time of the study. The student group seemed to perceive all the items or variables related to the occupational areas and evaluation components as being highly important. Besides, the student groups residing in the United States at the time of the study might have been greatly influenced by the United States educational system in which the use of evaluation for staff promotion and for the justification of educational expenditures and funding is emphasized. Of course, one would have expected that the university personnel by virtue of their profession would rate the two variables highest among the groups.

Final judgment regarding the evaluation components of the industrial technology programs

Because the analyses of variance of the mean responses of the groups studied revealed consensus (sometimes with relatively low means) and significant differences among the groups, the data were subjected to further analysis using the scatterplot. The purpose of the scatterplot was to eliminate those

items or variables that did not cluster with the rest of the variables.

Figures 9, 10, 11, 12, 13, and 14 reveal that all the plotted mean item responses clustered, indicating that the four groups responded similarly to the variables in the questionnaire.

In order to finally identify the evaluation components to be included in the industrial technology programs, the overall group means for each variable related to question 3 of the study were plotted. The cut-off point was established at 3.99. The following list of evaluation components emerged in order of importance for the evaluation of the industrial technology programs (the numbers in parentheses represent the item number in the questionnaire) (see Figure 15).

1. The programs should be evaluated to ensure that they are consistent with the occupational needs of the country (87).

2. The department should frequently evaluate educational resources, programs and facilities to determine limitations and possibilities needed to assess the extent to which they meet the goals, philosophy and objectives of the department and instruction (73).

3. The department and industry should work together to develop, administer and interpret forms for on-the-job training evaluations (88).

4. The department should embark on a comprehensive evaluation system in order to identify strengths and deficiencies of faculty performance, thus helping them improve upon their performance (77).

5. Evaluation should be used as a tool to determine program deficiencies with a view to taking corrective action (80).

6. The department administration in cooperation with industry should conduct a follow-up study of graduates to determine strengths and weaknesses of their job preparation and ways to improve the programs (84).

7. The programs and facilities should be assessed in order to make decisions regarding the assignment of teaching personnel, support personnel and student selection (75).

8. Evaluation of the program and facilities should be carried out annually to generate data needed by the universities to determine the worth of the existing programs (74).

9. The teaching methods should be evaluated to insure that the range of students' learning capabilities are accommodated (82).

10. Utilizing a competency model developed by the department and industry, both agencies should evaluate the employees performance on the job in order to modify the training programs where necessary (86).

11. A team of external experts, internal personnel, community businesses, industry personnel and some lay citizens should be involved in reviewing the department's objectives, evaluation procedures, content, personnel and programs and make recommendations for bringing the programs closer to meeting the needs of the students and the community (85).

Summary

Background information about the respondents of the study revealed that a majority of them were males (79.0%) with the age range from 31 to 40 years (Tables 9 and 13). The female respondents constituted a very small percentage (3.0%). Of

the total number of 133 persons who provided data for the study, 22.6% were university lecturers, 41.4% were industry personnel (directors, managers and top executives), 7.5% were technical education administrators in the State Ministries of Education across the Federal Republic of Nigeria.

The study also revealed that 87.9% of the respondents were Nigerian nationals while 12.1% were foreign nationals. Also, a majority (74.4%) had a college degree while less than 1.0% had only a high school certificate or its equivalent. Regarding the highest academic qualifications of the people surveyed, it was found that 73% had varying experiences in their respective jobs ranging from one to ten years.

The analysis of the data collected by interviewing the program coordinators of the department of industrial technology/engineering technology in the federal universities of technology and the industry personnel in Nigeria revealed the following:

1. Only the department of industrial education in the University of Nigeria, Nsukka had implemented a close educational cooperative relationship with some Nigerian industries.
2. The other four new federal universities of technology were willing to cooperate with the Nigerian industries.
3. A large percentage (85.5%) of the Nigerian industries

were cooperating with the older Nigerian universities prior to the study.

4. A moderately large percentage (72.7%) of the Nigerian industry personnel indicated that the Nigerian college graduates were not meeting their needs for skilled manpower requirements because the graduates lacked practical knowledge of industrial processes.
5. The four new federal universities of technology surveyed had not started fully to operate their industrial technology/engineering technology programs due to insufficient number of lecturers and lack of adequate facilities and equipment since most of these universities have originated very recently.
6. The new federal universities of technology were at the time of the survey offering courses such as Engineering, Drawing, Workshop Practice, Basic Sciences, General Studies, for their engineering students as an interim measure. Programs were being planned, facilities were under construction and equipment was being purchased.

The findings related to the three questions of the study revealed that the four groups surveyed, namely, the university personnel, the industry personnel, the technical education administrators, and the industrial technology students responded similarly to a majority of items. The

Scheffe's Multiple Range Test showed that a few variables yielded discriminating responses, especially between the industry personnel and the graduate students. However, upon further analysis of the data using the scatterplot analysis, it was found that the four groups responded similarly to the items more than was revealed by the analysis of variance statistics and the Scheffe's Multiple Range Test. The scatterplot analysis also served to identify those mean item responses in which there was extreme disagreement among the four groups and to enable the reader to examine the whole set of data.

Using the scatterplot analysis and the overall group means for each item, four dominant curriculum approaches (comprised of 19 variables), namely, research/philosophical approach, startegic planning approach, occupational guidance approach, and cooperative approach, all of which were rated "highly important", were identified for emphasis in the industrial technology programs.

In relation to question 2 of the study, 14 occupational areas were identified as constituting acceptable levels of importance based on the ratings of the four groups. These occupational areas were grouped under seven major occupational clusters, namely, health, transportation, communications, power and energy, construction and manufacturing, and management occupations, for emphasis in the industrial

technology programs in Nigeria.

The following items or variables received relatively low ratings in the study, and hence should receive less emphasis in the industrial technology programs.

A. Curriculum approach:

1. Giving the students the opportunity to participate in the planning of course content.

2. Establishing a comprehensive list of resource people in the community along with community resources that can be utilized in the instructional programs.

B. Occupational areas:

3. Printing occupations

4. Wood machinging occupations

5. Fabricating, assembling and repairing occupations (wood products).

6. Clay, glass, stone and related materials machining occupations.

The study also revealed that 11 evaluation components should be emphasized in the evaluation of the industrial technology programs in the Nigerian federal universities of technology. The evaluation focuses mainly on the curriculum, facilities, goals, philosophy and objectives of the department, the community and the country at large.

CHAPTER V. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter has been divided into four subheadings for discussion purposes: (1) introduction, (2) summary of findings, (3) conclusions, and (4) recommendations for further research.

Introduction

The problem of this study was to investigate the curriculum approaches, occupational emphasis, and program evaluation components of industrial technology programs within the Nigerian federal universities of technology.

The primary purpose of this study was to develop a model plan for use by the educational administrators and planners in upgrading and reconstructuring the existing industrial technology programs in the federal universities of technology in Nigeria.

The study was structured to include the following considerations:

1. Curriculum approaches to be emphasized
2. Occupational areas to be emphasized
3. Evaluative practices, processes, and guidelines to be utilized in the industrial technology programs.

The study was also designed specifically to answer the following questions:

1. What curriculum approaches should be emphasized in the federal universities of technology for industrial programs to contribute to students' adjustment to technological changes in Nigeria?
2. What occupational areas should be emphasized in industrial technology program planning in response to national manpower demands, students' needs and the requirements of industry?
3. How should the programs and or curriculum be evaluated?

The subjects of the study were:

1. All industrial technology/engineering faculty members in the five operating universities of technology in Nigeria, including the University of Nigeria, Nsukka.
2. Directors/managers/top executives of 100 manufacturing industries randomly selected from the four main industrial zones across the Federal Republic of Nigeria.
3. Nineteen administrators of technical education in the 19 Ministries of Education in Nigeria.
4. Forty-two Nigerian graduate students currently enrolled in industrial technology/education programs in selected United States universities.

Questionnaires developed as a result of literature review

and personal interviews were used to collect the data for the study. A total of 133 responses were received out of 190 subjects selected for the study. This represented a 70% return. The different categories of information gathered from the four groups of respondents were used to analyze the data.

Summary

The background information indicated that a majority of the respondents were males (79.0%) with the age range between 31 and 40 years. The female respondents constituted only 3.0% of the sample used in the study. Of the total number of 133 persons that participated in the study, 22.6% were university lecturers, 41.4% were industry personnel, 7.5% were technical education administrators, while the other 28.6% were Nigerian industrial technology/education graduate students studying in the United States.

It was found that 87.9% of the participants of the study were Nigerians while 12.1% were foreign nationals. Also, 71.4% of the respondents were working the southern states while 28.6% were working in the northern states at the time of the study.

A majority of the participants of the study (74.4%) earned college degrees and certificates, 21.1% had acquired a college of technology diploma, 3.8% with technical school

diploma and an insigificant percentage (0.8%) had only a high school certificate.

As this study was essentially based on the information provided by the four groups of respondents, it was necessary to assess their experience in their respective jobs. It was found that 73% had experiences in their jobs ranging from one to ten years.

The study revealed that the new federal universities, at the time of the study, had not established any educational ties with the Nigerian industries but were willing to co-operate with the industries as soon as their curricula were fully developed.

It was also found that a majority of the industries surveyed (85.5%) had had educational ties with the older Nigerian universities and other institutions of higher learning by way of exchange programs, industrial attachment programs and internships.

In relation to the status of the Nigerian university graduates employed by industries, 72.7% of the industries indicated that the graduates lacked appropriate practical skills and therefore were not meeting their needs for skilled manpower. Clearly, it can be concluded that the industrial attachment, internships and other cooperative educational or training programs will constitute a significant approach to provide reinforcement of theory through practice in real work.

situations. For the universities to be able to produce persons with appropriate employability skills and behaviors and job-related skills, they should maintain a balance between practice and theory.

With respect to the three questions of the study, the analysis revealed that the four groups of respondents responded similarly to a majority of the items in the questionnaire. However, the analysis of variance of the means showed that a few items yielded discriminating responses, especially between the industry personnel and the industrial technology graduate students. The two groups of respondents were found to be significantly different at the 0.01 and 0.05 levels of probability, in their responses to 15 items related to the three questions of the study as indicated in Tables 19, 20, 22, and 23.

The data were further analyzed using the scatterplot analysis and the overall group means of each item to identify the items that constitute acceptable levels of importance. Those items accepted were rated "highly important" and above on the basis of the overall group means.

Conclusions

In summary, the following were the major conclusions of this study:

1. Regarding question 1 of the study, 19 items or vari-

ables were identified under four dominant curriculum approaches to be emphasized in the federal universities of technology for industrial technology programs to contribute to the students' adjustment to technological changes in Nigeria. The curriculum approaches include research/philosophical approach, strategic planning approach, occupational guidance approach and cooperative approach (pp. 169-170).

2. Fourteen occupational areas emerged as acceptable areas of emphasis in the industrial technology program planning in the federal universities of technology in Nigeria, in response to national manpower demands, students' needs and the requirements of industry. The 14 occupational areas may be classified within seven occupational clusters: health, transport, communications, power and energy, construction, manufacturing and management (pp. 183-185).

Manpower development should be geared towards the occupational clusters identified in this study. Adoption of broad occupational cluster concept by the Nigerian federal universities is necessary for persons to be able to transfer their skills and training in response to technological changes in the world of work.

3. Eleven evaluation components were found to be highly

important in the evaluation of the industrial technology programs in the federal universities of technology in Nigeria. The evaluation components focus mainly on the cirruculum, facilities, goals, philosophy and objectives of the department, the community and the country (pp. 195-196).

Implications of the Findings

Industrial technology has been the subject of renewed interest the world over. Developing countries are becoming aware of the need for appropriate or intermediate technology transfer into their countries for the production of goods and services that can compete favorably in the world market.

Nigeria has realized the need for the technological changes with respect to the production of goods and services through the development of universities of technology which, together with industries, will serve as data bases and information centers.

This study clearly revealed, among other things, that Nigeria is becoming aware of the need to educate its youth regarding the effects of technological advances on the production of goods and services in industry and the provision of instructions in several occupational areas. This realization will help to reveal and develop the students' talents in technological and scientific fields and also maximize trans-

ferrability of skills and techniques in a cluster of related occupations.

Because technology is never static but dynamic, it becomes imperative that appropriate curriculum approaches should be selected and emphasized in accordance with the changing technology. It was found that the participants of this study would like to see the Nigerian students encouraged to read and interpret drawings and blueprints used in the industry. The study recently conducted by the United Nations Research Institute indicated that trainees in developing countries had special problems in following a blueprint or technical drawing for the purpose of building, repairing, understanding or operating a piece of equipment. This study concluded that blueprints, technical drawings, diagrams, models are a common medium of communication in modern technology.

One interesting finding in this study was the emphasis on maintenance and repairing occupations as revealed by the high ratings by the respondents in this particular area. In most developing countries (including Nigeria), maintenance used to be associated with low social status. The cleaning of a machine after use and lubrication are tasks which are frequently left to lower level manpower (UNESCO, 1979, p. 37). Perhaps Nigerians are realizing the huge wastes involved in replacing damaged machines and equipment or flying the expatriates into the country to repair them. The need to the

indigenous manpower in the use, maintenance, and repair of sophisticated equipment and tools was supported by the United Nations report stating:

> Most of the problems of maintenance and repair in the developing countries, where scarcity of capital is a major obstacle to industrialization requires no elaboration. In such circumstances, the prevention of the wastage and immobilization of equipment as a result of inefficient maintenance practices and inadequate region facilities is even more desirable than in developed countries (UNESCO, 1979, p. 37).

Another study by International Labor Organization (ILO) which was reported by UNESCO (1979) referred to the importance of the role played by skilled maintenance workers and pointed to the need for self-reliance among such workers in developing countries. Perhaps a course in maintenance and repairs, especially of sophisticated equipment in the industrial technology departments, should be an integral part of occupational preparations.

One interesting finding that deserves particular attention was the emphasis revealed by the study on providing the students with research and problem-solving activities to enable them to acquire skills in the industrial processes. This is an important issue because the interview with the industry personnel revealed that the Nigerian graduate lacked the appropriate skills and practical knowledge needed for the production of goods and services in the industry. The academically oriented type of high school and university courses cannot meet the need for skilled manpower in Nigeria.

The Nigerian educational institutions need to maintain a balance between theoretical and practical knowledge in order to exploit, to the fullest, the natural resources of the country for socioeconomic development.

It was projected in the Fourth National Development Plan that the total gainful occupations would increase from 30.8 million in 1980 to 34.6 million in 1985. This means that about 4 million employment opportunities are expected to be generated if the plan were to be implemented, thus reducing the unemployment rate slightly to about 4% by 1985. Nigeria cannot achieve the above objective if its universities continue to rely heavily on academic courses and neglect technical courses.

It was found in this study that such occupations as machining of wood, glass, stone and related machining occupations should not be emphasized in industrial technology program planning. This seemed to lend support to the study conducted by Kozak and Richards and reported by Anderson (1983, p. 52). The study revealed that woodworking among other occupational areas should not be emphasized in industrial technology programs. Perhaps these areas are becoming less dominant in the world of work.

A review of literature revealed that countries in their early stages of industrial development require general machinist courses but as industries become more specialized,

the general machinist courses could be subdivided into specialized courses, such as lathe turning, precision grinding, milling etc.

Industrial arts practices and procedures have been seriously criticized for the past two decades. This generated a need for program planning and program evaluation and assessment in industrial arts education.

Program planning at all levels of schooling, especially at the university level, is very important in order to insure that the program contents are responsive to the ever-changing technology. Program evaluation is also necessary from the standpoint of accountability. As stated in the Fourth National Development Plan (1981-85) (Federal Ministry of National Planning, 1981, p. 259-260), the federal government of Nigeria has invested the sum of 400.2 million naira (600.3 million dollars) while the state governments invested the sum of 736.649 million naira (1104.97 million dollars) in technical education. Also, the planned capital expenditure for the universities was estimated at 1.250 billion naira (1.88 billion dollars) which represents 50% of the total investment in the education sector. It is, therefore, almost imperative that the educational programs be evaluated occasionally to insure accountability of expenditures as indicated in this study. New programs need even closer review in order to make essential adjustments in the curricula and

instructional emphasis.

It should be noted that the curriculum approaches, occupational areas, and evaluation components identified in this study, for emphasis in the industrial technology programs, were designed to complement other educational plans by the federal universities of technology that will lead to the success of industrial technology programs in Nigeria. The areas of emphasis identified in this study will help to monitor and evaluate the industrial technology programs to insure that they keep abreast of technological changes in the world of work.

Recommendations

In view of the findings of this study, it was recommended that:

1. This study be replicated and more variables included to develop a more comprehensive plan after the new federal universities of technology have been in existence for five or more years.
2. A similar study can be conducted to determine the general facilities to be incorporated in the industrial technology programs.
3. Studies should be conducted periodically to determine the teaching innovations to be emphasized in the industrial technology programs in response to

the changing technology.

4. A follow-up study of the graduates of industrial technology programs should be conducted to determine whether or not they are meeting the needs for skilled manpower requirements in Nigeria.

REFERENCES

Abubakar, Iya. Science and technology in national development. In A Philosophy for Nigerian Education: Proceedings of the Nigerian Curriculum Conference. Ibadan, Nigeria: Educational Books (Nig) Ltd., 1969.

Adaralegbe, Adeniji. Science and technology in national development: Summary and recommendation. In A Philosophy for Nigerian Education: Proceedings of the Nigerian Curriculum Conference. Ibadan, Nigeria: Educational Books (Nig) Ltd., 1969.

Alex, Thomas. Gandhi and the 6-3-3-4 system of education in Nigeria. Daily Sketch (Ibadan), Jan. 25, 1983, p. 7.

Aluko, S. A. Education and manpower. In A. Ayida and H.M.A. Onitiri (eds.), Reconstruction and Development in Nigeria: Proceedings of a National Conference. Ibadan: Oxford University Press, 1971.

Amadi, C. O. Towards a solid technological base. Daily Times of Nigeria (Lagos), August 28, 1982, p. 3.

American Vocational Association. Standards of Attainment in Industrial Arts Teaching. Washington, D.C.: American Vocational Association, 1934.

American Vocational Association. A Guide to Improving Instruction in Industrial Arts. Washington, D.C.: American Vocational Association, 1968.

Anderson, A. L. Graphic communications instruction for industrial arts teacher education and industrial technology degree programs. Unpublished doctoral dissertation. Iowa State University, Ames, Iowa, 1983.

Arnold, G. Modern Nigeria. London: Longman's Group Ltd., 1977.

Ashby, Eric. Investment in Education. Report of the commission on post-school certificate and higher education in Nigeria. Lagos: Federal Ministry of Education, 1960.

Asiodu, P. C. Industrial policy and incentives in Nigeria. Journal of Economic and Social Studies, 1967, 9(2), 161-174.

Asiodu, P. C. Planning for further industrial development in Nigeria. In A. Ayida and H.M.A. Onitiri (eds.), Reconstruction and Development in Nigeria: Proceedings of a National Conference. Ibadan: Oxford University Press, 1971.

Ayida, A. A. and H.M.A. Onitiri. Reconstruction and Development in Nigeria: Proceedings of a National Conference. Ibadan: Oxford University Press, 1971.

Babatunde, T. D. Capital Accumulation and Technology Transfer. New York: Frederick A. Praeger Publishers, 1975.

Barrett, Lindsay. Nigerian steel: The count down begins. West African Magazine, Jan. 1982, p. 82.

Boaz, H. E. Degree-level technology programs offered in industrial education education departments, their status, accreditation and acceptance. (Doctoral dissertation, University of Missouri, 1965). Dissertation Abstracts, 1966, 27, 1533.

Borg, W. and G. Gall. Educational Research. New York: Longman's Inc., 1979.

Broudy, H. S. The Real Work of the Public Schools. New York: Harcourt Brace Javanovich, 1972.

Burns, A. History of Nigeria. London: George Allen and Unwin Ltd., 1972.

Buckley, E. C. Integrated courses in universities and industry. In O. Ojeamiren and P. Ayeni (eds.), University and Industry. A symposium held at the Institute of Technology, Benin City, Nigeria. Ibadan: The Caxton Press (West Africa) Ltd., 1971.

Buoro, Tini. Steel plant in trouble. National Concord (Ikeja), Feb. 11, 1983, p. 9.

Callaway, A. A. Education and manpower. In A. Ayida and H.M.A. Onitiri (eds.), Reconstruction and Development in Nigeria: Proceedings of a National Conference. Ibadan: Oxford University Press, 1971.

Carey, W. F. White collars for all. Speech to Utah Motor Transport Association and Salt Lake City Chamber of Commerce, held October 14, 1964. Washington, D.C.: U.S. Chamber of Commerce, 1964.

Chukwu, E. N. Address of welcome presented during the reception of the first students of the Federal University of Technology, Yola, Nigeria, Feb. 4, 1983.

Clark, E. D. University and industry: Partnerships in progress. In A. Ojeamiren and P. Ayeni (eds.), University and Industry. A symposium held at the Institute of Technology, Benin City, Nigeria. Ibadan: The Caxton Press (West Africa) Ltd., 1971.

Copeland, L. L., Sr. Industrial arts: A call for change. Man Society Technology: Journal of the American Industrial Arts Association, April 1982, 41(7), 10-12.

Council of Heads of Technological Institutions in Nigeria (COHEAD). Polytechnics in Nigeria. Daily Times of Nigeria (Lagos), August 24, 1982, p. 17.

Court, Anne. The states as brokers for federal jobs programs. Vocational Education: Journal of the American Vocational Association, September 1978, 53(6), 52-54.

Crawford, B. Scope and sequence of content. In W. Ray and J. Streichler (eds.), American Council on Industrial Arts Teacher Education, 20th Yearbook. Bloomington, Illinois: McKnight and McKnight Publishing Company, 1971.

Daily Times. Steel mill in Lagos. Daily Times of Nigeria (Lagos), August 24, 1982, p. 23.

Daily Times. Graduate unemployment in Nigeria. Daily Times of Nigeria (Lagos), Oct. 17, 1982, p. 17.

Damachi, U. Manpower in Nigeria. In U. Damachi and H. D. Seibel (eds.), Social Change and Economic Development in Nigeria. New York: Praeger Publishers, 1973.

David-West, Tam. Need for states to adopt the 6-3-3-4 system of education in Nigeria. Daily Times of Nigeria (Lagos), Oct. 27, 1982, p. 3.

Davis, W. Labor and vocational education: What should be taught? Address presented to the National Bicentennial Conference on Vocational Education, University of Minnesota, Minneapolis, Minn., Oct. 1976.

Dean, C. T. Implications for future planning. In C. Dean and N. Hauer (eds.), American Council on Industrial Arts Teacher Education, 18th Yearbook. Bloomington, Illinois: McKnight and McKnight Publishing Company, 1969.

DeVore, P. W. Technology: Its Impact on Industrial Arts Education. Blacksburg, Virginia: Virginia Polytechnic Institute and State University, May 1975.

Dimawo, Sam. Launching pad for Nigerian technology. Daily Times of Nigeria (Lagos), Feb. 18, 1983, p. 7.

Drake, St. Claire. Social change and social problems in contemporary Africa. In W. Goldschmidt (ed.), The United States and Africa. New York: Frederick A. Praeger Publishers, 1965.

Drior, Yehezkel. Planning process: A facet design. International Review of Administrative Sciences, 1975, 29(1), 44-68.

Dugger, W. E., Jr. The standards for industrial arts program project: An overview. Journal of Industrial Teacher Education, 1982, 18(1), 12.

Egbochukwu, Stanley. Cement industry in Nigeria. Concord Business (Ikeja), Jan. 14, 1983, p. 4.

Erber, E. E. Industrial technology implications for industrial and technical teacher education. In C. Dean and N. Hauer (eds.), American Council on Industrial Arts Teacher Education, 18th Yearbook. Bloomington, Illinois: McKnight and McKnight Publishing Company, 1969.

Esen, A. The Nigerian university: Towards more relevance. In U. Damachi and H. D. Seibel (eds.), Change and Economic Development in Nigeria. New York: Praeger Publishers, 1973.

Essien, Nsikak. Giving Nigerian technology a chance. Business Concord (Ikeja), Feb. 11, 1983, p. 7.

Federal Ministry of Education and Development Section/UNESCO Planning Team. Workshop for Junior Secondary Schools. Lagos: Federal Ministry of Education Printing Division, 1981.

Federal Ministry of Education, Planning and Development Division. Planning for Junior Secondary Education: Report of the First National Workshop, Implementation Committee for the National Policy on Education, Lagos, 1977.

Federal Ministry of National Planning. Second National Development Plan. National Planning Office, Federal Ministry of National Planning, Lagos, 1971.

Federal Ministry of National Planning. Third National Development Plan. National Planning Office, Federal Ministry of National Planning, Lagos, 1975.

Federal Ministry of National Planning. Studies for the Fourth National Development Plan: Directions of Industrial Development in the 1980s. Federal Ministry of National Planning, Lagos, 1979.

Federal Ministry of National Planning. Fourth National Development Plan (1981-85). National Planning Office, Federal Ministry of National Planning, Lagos, 1981.

Federal Republic of Nigeria. National Policy on Education. Federal Ministry of Education Printing Division, Lagos, 1977.

Federal Republic of Nigeria. Report of the Presidential Commission on Parastatals (Onosode Report). Federal Government Press, Lagos, 1981.

Folayan, O. and S. U. Abdulkadir. Technical training in Nigeria. Vocational Education: Journal of the Kaduna Ministry of Education, 1981, 1(1), 29-30.

Foy, R. Industrial arts--technology education: Are we ready? Man Society Technology: Journal of the American Industrial Arts Association, May/June 1982, 41(8), 2.

Friese, John F. and A. W. Williams. Course Making in Industrial Education. Third Edition. Peoria, Illinois: C. A. Bennett Co., 1966.

Hales, J. and J. Synder. Jackson's Mill industrial arts curriculum theory: A base for curriculum derivation. Man Society Technology: Journal of the American Industrial Arts Association, March 1982, 41(6), 6-10.

Hammond, J. J. What should be taught in the future? Address presented to the National Bicentennial Conference on Vocational Education. University of Minnesota, Minneapolis, Minn., 1976.

Harbinson, F. H. Manpower Education. New York: McGraw-Hill Book Company, 1965.

Harbinson, F. H. Human Resources as the Wealth of Nations. Proceedings of the American Philosophical Society, 1971, 115(6), 427-431.

Harris, J. N. Proposed criteria for self-evaluation of four-year industrial technology programs. (Doctoral dissertation, Wayne State University, 1969). Dissertation Abstracts International, 1970, 31, 1597A.

Henry, Roger. The future workers: Who are they and what can industrial arts offer them? Man Society Technology: Journal of the American Industrial Arts Association, April 1982, 14(7), 15-16.

Ighedo, J. A. Manpower feasibility study with implications for vocational technical education in Bendel State of Nigeria. Unpublished doctoral dissertation. Iowa State University, Ames, Iowa, 1979.

Iloeje, N. P. A New Geography of Nigeria. New edition. Ibadan: Longman's (Nigeria) Ltd., 1973.

Iowa Department of Public Instruction. Iowa State Plan for the Administration of Vocational Education. Department of Public Instruction, Des Moines, Iowa, 1980.

Kaita, S. M. Making Nigerian technical education effective and functional. Vocational Education: Journal of the Kaduna State Ministry of Education, 1981, 1(1), 12-13.

Keith, C. W. The industrial technology programs at Kent State University: An appraisal and recommendations. (Doctoral dissertation, The Ohio State University, 1964). Dissertation Abstracts, 1966, 25, 4478.

Keller, Franklin J. The Comprehensive High School. New York: Harper and Brothers, 1955.

Kriegbaum, Richard. Insight: Teaching the Post-Industrial Society. Technical Foundations of America, Wheaton, Illinois, 1983.

Lewis, M. E. An investigation of the relevancy of selected areas of the industrial technology curricula to the expectations of industry. (Doctoral dissertation, State University of New York at Buffalo, 1970). Dissertation Abstracts International, 1970, 31, 2011.

Lewis, W. A. Development Planning: The Essentials of Economic Policy. London: Allen and Unwin, 1966.

Ludwig, Schatzl. Industrialization in Nigeria: A Spatial Analysis. Nigerian Institute of Social and Economic Research, University of Ibadan, Ibadan, Nigeria, 1973.

Maley, Donald. Perspective on the future: Industrial arts plays a key role in future education. Man Society Technology: Journal of the American Industrial Arts Association, 1980, 40(4), 10-15, 29-32.

Maley, Donald. Putting theory into practice. Man Society Technology: Journal of the American Industrial Arts Association, May/June, 1982, 41(8), 3-11.

Ministry of Education, Eastern Nigeria. Education Handbook. Official Document No. 16. Enugu: Government Printer, 1964.

National Nigerian Universities Commission. Basic Information Kit on Nigeria, Vol. 1, No. 2. Nigerian Universities Commission, Washington, D.C., 1982.

New Nigeria. Manpower shortage in Nigeria. New Nigerian Newspaper (Kaduna), August 6, 1975, p. 6.

Odubona, Soga. Ajaokuta steel complex. Daily Times of Nigeria (Lagos), Nov. 14, 1982, p. 3.

Offiongodon, A. M. Industrial development and technical skills. Sunday Standard (Jos), June 6, 1982, p. 5.

Ogunpola, G. A. Government investment in industry. In O. Teriba and M. O. Kayode (eds.), Industrial Development in Nigeria. Ibadan: University of Ibadan Press, 1977.

Ogunshe, A. Education and manpower. In A. Ayida and H.M.A. Onitiri (eds.), Reconstruction and Development in Nigeria: Proceedings of a National Conference. Ibadan: Oxford University Press, 1971.

Okafor, Anthony. Revamping Nigeria's coal industry. Daily Times of Nigeria (Lagos), Jan. 13, 1983, p. 7.

Okorie, Emma. Increasing the productivity of Nigeria's workers. Daily Times of Nigeria (Lagos), Oct. 21, 1982, p. 7.

Olson, D. W. Technology and Industrial Arts. Columbus, Ohio: Epsilon Pi Tau, Inc., 1957.

Oni, O. and Onimode, O. Economic Development of Nigeria. Ibadan: The Nigerian Academy of Arts, Science and Technology Publication, Ibadan, 1975.

Onyemelukwe, C. C. Problems of Industrial Planning and Management in Nigeria. New York: Columbia University Press, 1966.

Oyejide, T. A. The strategy of industrial development. In A. Ayida and H.M.A. Onitiri (eds.), Reconstruction and Development in Nigeria: Proceedings of a National Conference. Ibadan: Oxford University Press, 1971.

Phillips, G. O. Chairman's introduction. In A. Ojeamiren and P. Ayeni (eds.), University and Industry. A symposium held at the Institute of Technology, Benin City, Nigeria. Ibadan: The Caxton Press (West Africa) Ltd., 1971.

Ray, W. E. and J. Streichler (eds.). Components of Teacher Education, 20th Yearbook. Bloomington, Illinois: McKnight and McKnight Publishing Company, 1971.

Sogbesan, E. Nigeria needs liberal education system. Daily Times of Nigeria (Lagos), Dec. 27, 1973, p. 7.

Stokke, Olav. Nigeria: An Introduction to the Politics, Economy and Social Setting of Modern Nigeria. Uppsala, Sweden: The Scandinavian Institute of African Studies, 1970.

Strom, I. E. A comparative analysis of industrial technology education in Minnesota and the requirements of industry. (Doctoral dissertation, University of Northern Colorado, 1970). Dissertation Abstracts International, 1971, 32, 2149A.

Teriba, O. and Kayode, M. O. Issues in industrialization. In O. Teriba and M. O. Kayode (eds.), Industrial Development in Nigeria. Ibadan: Ibadan University Press, 1977.

The Nigerian Handbook. London: The Crown Agents for Overseas Governments and Administrators, 1954.

United Nations. Vocational Training in Development Countries: A Survey of Expert Experiences. U.N. Research Institute for Social Development Report No. 73-1, Geneva, 1973.

United Nations Educational Scientific and Cultural Organization (UNESCO). Developments in Technical and Vocational Education: A Comparative Study. Paris: UNESCO Secretariat, 1979.

United States Department of Labor (Bureau of Labor Statistics). Counting the Labor Force. National Commission on Employment and Unemployment Statistics. Washington, D.C.: U.S. Government Printing Office, 1979.

United States Department of Labor (Bureau of Labor Statistics). Occupational Projections and Training Data. Washington, D.C.: U.S. Government Printing Office, 1980.

Unruh, Glenys G. Responsive Curriculum Development. Berkeley, California: McCuthan Publishing Corporation, 1975.

Uwagboe, D. O. Manpower requirements for economic and industrial development. In A. Ojeamiren and P. Ayeni (eds.), University and Industry: A symposium held at the Institute of Technology, Benin City, Nigeria. Ibadan: The Caxton Press (West Africa) Ltd., 1971.

Van Ast, John. Occupational Analysis and Course Construction: Systematic Planning Procedures. Department of Industrial Education and Technology, Iowa State University, Ames, Iowa, 1981.

Vescera, T. P. and P. A. Dimeo. Industrial arts education: Futurism and professional responsibility. Man Society Technology: Journal of the American Industrial Arts Association, 1982, 41(5), 14.

West Africa. Industries, iron and steel in Nigeria. West Africa. London: West African Publishing Company, Jan. 1982, p. 186.

West Africa. Steel production in Nigeria. West Africa. London: West African Publishing Company, Oct. 1982, p. 2639.

Wolansky, W. D. Multiple Approaches to Improving the Development of Apprenticeship/Vocational Technical Training Programs. National symposium on Meeting National Manpower Needs through Apprenticeship and Vocational Training, Jos, Plateau State, Nigeria, 1981.

Woodhall, M. and V. Ward. Economic Aspects of Education: A Review of Research in Britain. Bootle, Lacs: John Gardner (Printers) Ltd., 1972.

Yakubu, Momodu. Factors that impede industrialization in Nigeria. Daily Times of Nigeria (Lagos), Jan. 4, 1983, p. 7.

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The Iowa State University Committee on the Use of Human Subjects in Research reviewed this project and concluded that the rights and welfare of the human subjects were adequately protected, that risks were outweighed by the potential benefits and expected value of the knowledge sought, that confidentiality of data was assured and that informed consent was obtained by appropriate procedures.

APPENDIX A. LETTERS OF TRANSMITTAL AND QUESTIONNAIRE

Iowa State University of Science and Technology Ames, Iowa 50011

College of Education
Industrial Education
Vocational Education Section
Telephone 515-294-2082

December 16, 1982

Dear Sir:

I am a Federal Nigerian Scholar on a Ph.D. program at Iowa State University of Science and Technology. I am presently conducting a research project in Industrial Technology designed to develop a master plan for programs and facilities of Industrial Technology in the Federal Universities of Technology in Nigeria. The main objective is to develop a program model in industrial technology consistent with Nigerian projected manpower. The results of this research, hopefully, will have considerable value for future plans and expansion of current programs geared towards meeting the social and economic needs of the country.

I need your input in this research by sacrificing about ten minutes of your precious time to complete the enclosed questionnaire.

I wish to emphasize that the responses on the instrument will be analyzed on a group basis and no attempts will be made to associate responses with individuals or institutions.

Thank you for your cooperation.

Sincerely,

John N. Ogbazi

John N. Ogbazi
Graduate Student

Approved by:

Dr. William Wolansky, Professor and Head
Department of Industrial Education and Technology
Iowa State University
Ames, Iowa 50011

Iowa State University of Science and Technology Ames, Iowa 50011

College of Education
Industrial Education
Vocational Education Section
Telephone 515-294-2082

December 16, 1982

Dear Fellow Student:

I am a Federal Nigerian scholar pursuing a Ph.D. degree at Iowa State University. I am presently conducting a research project designed to develop a master plan for programs and facilities of Industrial Technology in the Federal Universities of Technology in Nigeria. The main objective is to develop a program model in industrial technology consistent with Nigerian projected manpower. The results of this research, hopefully, will have considerable value for future plans and expansion of current programs geared towards meeting the social and economic needs of the country.

I am particularly desirous of obtaining your responses because your experiences in technical education doubtlessly will contribute immensely towards solving some of the educational problems facing Nigeria today.

It will be greatly appareciated if you spend ten minutes of your time to complete the following questionnaire and return it in the self-addressed envelope by January 30, 1983.

I wish to emphasize that the responses on the instrument will be analyzed on a group basis and no attempts will be made to associate responses with individuals or institutions.

Thank you for your cooperation.

Sincerely,

John N. Ogbazi

John N. Ogbazi
Graduate Student

Approved by:

William Wolansky

Dr. William Wolansky
Professor and Head, Department
of Industrial Education and Technology

QUESTIONNAIRE

To be completed by (1) Staff Members/Administrators in Industrial Technology Department in the Federal Universities of Technology
(2) Directors/Managers/Top Executives of Nigerian Industries
(3) Administrators of Technical Education
(4) Nigerian Students in Industrial Education/Technology in the U.S.A.

Introduction

This questionnaire is used to collect data for research purposes to plan effective programs and facilities of industrial technology in the Nigerian Federal Universities of Technology. Please answer each question. The data in this survey will be kept in strict confidence and will be analyzed as a group, not on an individual basis. Please respond to every item.

PART I

Personal Data

1. Sex: _____ 1. Male
   _____ 2. Female

2. Classification: _____ 1. University personnel
   _____ 2. Industry personnel
   _____ 3. Administrator of technical education
   _____ 4. Student

3. State of employment: _____

4. State of origin: _____

5. Age: _____ 1. 20-30 years
   _____ 2. 31-40 years
   _____ 3. 41-50 years
   _____ 4. 51 and above
   _____ 5. Other: Please specify
   (check one)

6. Present level of highest qualification:

   _____ 1. University or technical university
   _____ 2. College of technology
   _____ 3. Technical school
   _____ 4. Institutional vocational training
   _____ 5. West African School Certificate/GCE
   _____ 6. Other (please specify)

7. Years of experience on the job:
   _____ 1. 0-5 years
   _____ 2. 6-10 years
   _____ 3. 11-15 years
   _____ 4. Over 15 years
   _____ 5. No answer
   (check one)

8. Name of employer or institution: _____

PART II

The rapid movement towards automation in business and manufacturing industry, as a result of technological advancement, has changed the occupational requirements of the work force and the contribution of the Nigerian society towards economic development.

Check the degree (by making an "X") to which you feel the following curriculum approaches by industrial technology programs are important for students' adjustment to technological changes in Nigeria.

5 = Extremely important
4 = Highly important
3 = Somewhat important
2 = Slightly important
1 = Not important

	5	4	3	2	1
9. Teach students to understand how technological advances have changed the lives of people and to consider future conditions which may affect them.					
10. Teach students to understand the effects of technological advances on production of goods and services in industry.					
11. Provide instructions and learning activities and experiences in several occupational areas which reveal students' talents in technological and scientific fields, industry requirements and natural needs.					
12. Include contents in the industrial technology programs that are based on industrial procedures and problems, thus giving students a realistic picture of conditions prevailing in the world of work.					
13. Provide students with experiences in problem solving through research, creativity and concept development with basic tools and equipment fundamental to all industries or occupations.					

	5	4	3	2	1
14. Organize field trips to industries to help students improve their knowledge of industry, working conditions and work atmosphere.					
15. Expose students to many occupational areas in their freshman year so that they understand the training requirements, working conditions and salary/wage structure which may affect their occupational change later on.					
16. Teach some basic concepts and skills that are required by students to work in industry irrespective of their occupational areas (terminology, process, safety, materials etc.).					
17. Familiarize the students with the problems and prospects of industry and Nigerian society in order to motivate students to further their education.					
18. Provide the students with research and problem solving activities to enable them to acquire skills in the process of obtaining knowledge rather than just receiving knowledge.					
19. Survey various occupations occasionally to determine trends that might affect job requirements and conditions in the future.					
20. Give the students the opportunity to participate in the planning of course content.					
21. Occupational programs should be determined through cooperation among the National Universities Council, education planners, industry and labor, in order to meet the social and economic needs of Nigeria.					
22. The industrial technology programs should be based on the economic trends, manpower needs and students' interests.					
23. Give the students the opportunity to work cooperatively in groups in order to develop cooperative, communicative and leadership skills needed in the world of work.					
24. Provide opportunities for students to learn industrial processes and production through building projects that stimulate visual, mental, and physical capabilities.					
25. Involve students in problem-solving situations which involve meaningful application of other college subjects.					
26. Familiarize students with problems found in industry and employment by organizing small companies operating with personnel, manufacturing and marketing systems (Enterprise method).					

	5	4	3	2	1
27. Encourage students to read and interpret drawings and blueprints used in industry.					
28. Emphasize skill and technical knowledge in the programs rather than just broad general understanding.					
29. Teach trade skills that could ultimately lead to gainful employment.					
30. Offer more time remedial assistance to students having problems in practical courses.					
31. Emphasize experiences in mass production, product design and labor relations to give the students insight into industrial procedures (time and motion study).					
32. Select appropriate module or units of instruction a student should take to develop the skills necessary to work in a particular occupational area.					
33. Prepare and maintain a comprehensive list of, and develop channels of communication with work experience stations for students' planned occupational experience programs.					
34. Select new and different equipment which parallels the equipment the students will use after graduation.					
35. Establish a comprehensive list of resource people in the community along with community resources that can be implemented in the instructional programs.					
36. Teach the trainees how to work in modern enterprises with punctuality, regularity and efficiency.					
37. Familiarize students with maintenance and repairs so that they can later handle technical equipment themselves.					
38. Train students for various job possibilities through emphasis on poly-technical skills and transfer of training, so that they are always ready to adjust to new situations.					
39. Emphasize the production of a cadre of key personnel for economic and technological development.					
40. Develop industrial leadership in the students so that they might better prepare themselves for future development.					
41. Familiarize the trainees with the language and technical terminology used in training programs to facilitate communication with the trainer, and also comprehend the difficult concepts involved in the training program.					

	5	4	3	2	1
42. Organize conferences and seminars with employers in order to keep abreast of technological development and also improve on-the-job instruction.					
43. Develop and maintain training plan with cooperative employers.					
44. Provide students with resource materials on occupational opportunities.					
45. Maintain a liaison with federal, state and local employment agencies.					
46. Maintain a current file on job and employers.					
47. Develop a cooperative training agreement between students, school and employers.					
48. Familiarize students with management policies and the organizational structures of training sponsors.					
49. Plan a budget for equipment and supplies--current and projected--based on student enrollment.					
50. Establish a personnel needs survey study as a guide against unemployment and underemployment of graduates of the program.					
51. Establish public relations activities in order to educate the Nigerian public in the potential of industrial technology in the economic development of Nigeria.					

PART III

The major policy objective of the Nigerian government is to develop industry rapidly as a means of promoting rapid economic growth. To achieve this objective requires the training of more Nigerians in different levels of occupational areas in industry.

Please, in the light of national manpower demands presently and in the future, students' needs, and the requirements of industry, rate the following occupational areas on a scale of 1-5 with regard to their importance in the planning of industrial technology programs. The scale to be used is as follows:

5 = Extremely important
4 = Highly important
3 = Somewhat important
2 = Slightly important
1 = Not important

	5	4	3	2	1
52. Metal machining occupations					
53. Metal shaping and forming occupations					
54. Wood machining occupations					
55. Clay, glass, stone and related materials machining occupations					
56. Other machining and related occupations; e.g., engravers, filling, grinding, buffing, cleaning and polishing, patternmakers and moulders, inspecting and testing occupations					
57. Mining and quarrying including oil and gas field occupations					
58. Processing occupations: mineral, metal, clay, glass, stone, plastic, wood, chemicals, etc.					
59. Fabricating and assembling occupations (metal products) (construction)					
60. Fabricating, assembling, installing and repairing occupations (plastics)					
61. Fabricating, assembling and repairing occupations, wood products					
62. Foundry occupations (patternmakers, molders, core makers)					
63. Printing occupations					
64. Office occupations: clerical, banking, engineers, administrators, computer programmers etc.					
65. Scientific and technical occupations (conservation, engineers, environmental scientists, life scientists, mathematics, physical scientists)					
66. Other scientific and technical occupations (broadcast technicians, drafters, engineering and science technologists/technicians, surveyors, etc.)					
67. Mechanics and repairmen					
68. Health occupations					
69. Construction occupations					
70. Electronics					
71. Graphics					
72. Other (please specify)					

PART IV

Evaluation is an important component of educational program planning and acts as a guide towards achieving the objectives of the educational program and those of the institution.

The following is a list of evaluative practices, procedure, processes and guidelines that might contribute to the success of educational planning. Please rate each item to indicate the importance of its contribution to the success of program planning in industrial technology. Use the same scale as in PART II and PART III.

	5	4	3	2	1
73. The department should frequently evaluate educational resources, programs and facilities to determine limitations and possibilities needed to assess the extent to which they meet the goals, philosophy, and objectives of the department and instruction.					
74. Evaluation of the programs and facilities should be carried out annually to generate data needed by the universities to determine the worth of the existing programs.					
75. The programs and facilities should be assessed in order to make decisions regarding the assignment of teaching personnel, support personnel and student selection.					
76. Annual evaluation of the programs is necessary for the department administration to make defensive decisions regarding program changes, additions or deletions.					
77. The department should embark on a comprehensive evaluation system in order to identify strengths and deficiencies of faculty performance, thus helping them improve upon their performance.					
78. The promotion of faculty and support personnel should be based on the outcome of their evaluation.					
79. Faculty members should be involved in evaluation in order that they gain evaluative expertise that will help them plan and evaluate their own activities.					
80. Evaluation should be used as a tool to determine program deficiencies with a view to taking corrective action.					
81. The programs should be evaluated to insure accountability of expenditures through presentation of program results.					
82. The teaching methods should be evaluated to insure that the range of student's learning capabilities are accommodated.					

	5	4	3	2	1
83. A cost-related evaluation or assessment should be undertaken by the department in collaboration with industry, in relation to program attributes and outcomes.					
84. The department administration in cooperation with industry should conduct a follow-up study of graduates to determine strengths and weaknesses of their job preparation and ways to improve the programs.					
85. A team of external experts, internal personnel, community businesses, industry personnel and some lay citizens should be involved in reviewing the department's objectives, evaluation procedures, content, personnel and program contents and make recommendations for bringing the program closer to meeting the needs of students and the community.					
86. Utilizing a competency model developed by the department and industry, both institutions should evaluate the employees' performance on the job in order to modify training programs where necessary.					
87. The programs should be evaluated to insure that they are consistent with the occupational needs of the country.					
88. The department and industry should work together to develop, administer and interpret forms for on-the-job training evaluations.					

Optional: If you wish to receive a free copy of the study results, write your name and address below:

Name _____

Address _____
(Street) (Town) (State) (Zip)

John N. Ogbazi
Department of Industrial Education and Technology
Iowa State University
Ames, Iowa 50011

Interview with the Nigerian industry personnel

1. What office do you hold in this company?

2. How long have you been working for this company?

3. What does your company produce?

4. Do you have any relationship such as cooperative educational/training programs with the Nigerian universities presently and in the past?

5. In what fields/areas do you have the cooperative programs?

6. If you don't have such programs at present, do you plan to cooperate with the higher institutions in Nigeria in the training of skilled manpower?

7. How about the graduates you hire from the universities and colleges of technology, do you think they are adequately trained to meet your needs for skilled manpower?Why do you think so?

7. What changes would you like to see in the Nigerian university programs?

Interview with the program coordinators in the Federal Universities of Technology in Nigeria

1. Do you offer Industrial technology programs in your institution?

2. If you do, what is the scope and nature of the programs?

3. If you do not, do you feel we don't need such programs in Nigeria today?

4. Do you offer cooperative educational/training programs with the Nigerian industries?

5. If the answer in 4 is "No", do you have plans to establish such programs in future?

6. Technology education is known by different names in different universities, e.g. industrial technology, engineering technology, industrial education,etc., do you think that such names influence the nature and scope of your technology education programs? What is/are your reason(s) ?

APPENDIX B. LETTERS OF CORRESPONDENCE

Iowa State University of Science and Technology Ames, Iowa 50011

College of Education
Industrial Education
Vocational Education Section
Telephone 515-294-2082

June 18, 1982

File No: ED/PG/81/0506

The Permanent Secretary
Federal Ministry of Education
Scholarship Section
Lagos, Nigeria

Dear Sir:

Mr. John Ogbazi is a Federal Nigerian Scholar pursuing a Ph.D. degree in the Department of Industrial Education. We are requesting that consideration be given to him to provide funds for his research activities in Nigeria. The funds will include his travel costs, lodging and incidental expenses in collecting data for his Ph.D. degree research.

We believe that it is more beneficial for Nigerian students to research problems which are related to the economic development and education of their country than it would be to study U.S. problems. John's graduate committee encouraged him to conduct Nigerian related research.

His topic is: "The Determination of a Master Plan for the Programs and facilities of Industrial Technology in the Federal Nigerian Universities of Technology in Nigeria." There is no other way to collect these data than to visit with University administrators and actually interview the respective administrator responsible for Industrial Technology programs. Hopefully, the results of this research will have considerable value for future plans and expansion of current programs. A copy of his budget request is attached.

Mr. John Ogbazi has completed all his coursework, passed his preliminary examinations, and is now ready to engage in his research. He intends to return to Nigeria as early as he completes his Ph.D. degree. He should be able to complete all requirements for the degree no later than Sept 1983. Mr. Ogbazi

is expected to leave the United States for Nigeria by September 1982, for his research data in order to complete his studies on schedule. Your assistance will be greatly appreciated.

Sincerely,

William D. Wolansky
Professor and Head
Department of Industrial Education

WDW:ke

Att.

Iowa State University of Science and Technology Ames, Iowa 50011

College of Education
Industrial Education
Vocational Education Section
Telephone 515-294-2082

June 18, 1982

Budget for John Ogbazi

Return Air Travel - Des Moines to Lagos	$1,800.00
Local Transportation	1,500.00
Food, Meals, Lodging (30 days)	1,500.00
Recording Tapes	400.00
Supplies - Postage, telephone calls	200.00
Total	$5,400.00

REF: ED/SC/PG/81/0506

August 25, 1982

Mr. N. Iroaga
The Permanent Secretary
Federal Ministry of Education
Scholarship Section
Lagos, Nigeria

Dear Mr. Iroaga:

It is my responsibility to encourage graduate students to complete their research before they leave the campus for a permanent position. With international students it is almost imperative that students conduct research which is based on "home country" problems if they are to return and provide strong leadership after they return. Our experience has been that students are more likely to continue their research in problem areas which they initiate during their graduate studies.

Mr. John Ogbazi who is a Federal Nigerian scholar pursuing his Ph.D. degree in the Department of Industrial Education has done quality work in his coursework and passed his preliminary examinations qualifying him as a candidate for the Ph.D. degree in Industrial Education.

John is at a very difficult stage in his program as he must find the financial resources to make the trip to Nigeria to collect data for his research which is designed to--Determine a Master Plan for Programs and Facilities of Industrial Technology in the Federal Universities of Technology in Nigeria.

Unless John Ogbazi is able to secure scholarship funds, he will have to abandon his current proposal and the prospect of conducting home-oriented problem research. This would also delay his graduation considerably if he had to begin a new research proposal. I believe that if funds are made available to him, he can complete his research and graduate by September, 1983.

Sometime ago two other Nigerian students have completed their Ph.D. degree programs and have returned to work in Nigeria. Dr. Joshua Ighedo is working for the Industrial Training Fund and Dr. Raphael Orano is teaching at the University of Nigeria, Nsukka. Dr. Peter Awotunde and Ben Nwoke will be returning to Nigeria in the next 2 or 3 months. Dr. Nwoke will be teaching at the Federal University of Technology, Yola.

Our records show that most Nigerians completing the Ph.D. degree program do return to Nigeria and work in leadership positions.

I urge that every serious consideration be given to extend the Federal Government Scholarship to Mr. John Ogbazi so he can devote his energy to this important research and complete all the requirements for the Ph.D. degree. Mr. Ogbazi has considerable ability, enthusiasm and interest in returning to Nigeria and serve his country through the process of education of Nigerians.

Sincerely,

William D. Wolansky
Professor and Head
Department of Industrial Education

WDW:hw

cc: Mr. Chidi Chris Cornel Obi
John N. Ogbazi

Ref: ED/SC/PG/81/0506

Department of Industrial Education
Industrial Education II
Iowa State University
Ames, Iowa 50011

October 4, 1982

The Permanent Secretary
Attn: Mr. N. Iroaga
Federal Ministry of Education
Scholarship Section
Lagos, Nigeria

Dear Mr. Iroaga:

Enclosed for your necessary action is an outline of my thesis/ dissertation.

I am ready to return home for the data collection. As you know, this research will cover all the nineteen states of the Federation. The main objective of the study is to ascertain the type of information needed by our Federal universities of technology to assist them in planning programs and facilities in industrial technology. Such information definitely will help them develop quality programs geared towards meeting the social and economic needs of the country.

I will be grateful if the necessary arrangements are made to provide me with the funds as soon as possible so that my graduation might not be delayed. The estimated cost of my research has already been sent to you and it is $5,400.00.

I expect to hear from you soon.

Sincerely,

John N. Ogbazi

Enc.

Iowa State University of Science and Technology Ames, Iowa 50011

College of Education
Industrial Education
Telephone 515-294-1033

December 14, 1982

TO WHOM IT MAY CONCERN

Mr. John Ogbazi, a national scholar, has now completed all his coursework and preliminary examinations for the Ph.D. degree at Iowa State University majoring in Industrial Vocational Technical Education. He had his research proposal approved by his graduate research committee on Monday, December 13, 1982.

John's research will be directed at creating a program model in Industrial Technology that will be consistent with Nigerian projected manpower needs.

To make this research possible it is essential that financial support be provided to conduct the research. The procurement of data will be more costly than what we normally expect a doctoral student to expend on his research. At the same time we believe that in doing research related to his home country will be more fruitful to him and Nigeria.

Any support you can provide to Mr. John Ogbazi will be greatly appreciated.

William D. Wolansky
Professor and Head
Department of Industrial Education
and Technology

WDW:hw

Budget for John Ogbazi

Return Air Travel - Des Moines to Lagos	$1,800
Local Transportation	1,600
Food, Meals, Lodging (30 days)	1,500
Recording Tapes	600
Supplies, Postage, Telephone Calls	500
	$6,000

Iowa State University of Science and Technology Ames, Iowa 50011

College of Education
Industrial Education
Vocational Education Section
Telephone 515-294-2082

December 15, 1982

The Director
Trade and Development Program
Training Office
Washington, D.C.

Dear Sir:

I am a Federal Nigerian Scholar on a Ph.D. program in the above institution. I am conducting a study designed to develop a master plan for the programs and facilities of industrial technology in the Federal Universities of Technology in Nigeria. The results of this study will help the Nigerian Universities of Technology plan realistic educational programs that are geared towards meeting the social and economic needs of the country.

Incidentally, the Nigerian Students on Trade and Development Programs which you direct have been selected to participate in this study. I am particularly desirous of obtaining their responses because their experiences in technical/industrial education/technology will contribute immensely towards solving some of the educational problems that face Nigeria today.

It will be appreciated if you will send me the names and addresses of these Federal Nigerian students studying in the United States to enable me dispatch questionnaires to them. It may be important to inform you that this study will be sponsored by the Federal Government of Nigeria.

I learned from Lagos that there are about 1000 Nigerian students studying in the United States under your program.

Thank you for your cooperation.

Sincerely,

John N. Ogbazi

John N. Ogbazi
Graduate Student

Approved by:

William D. Wolansky

Dr. William D. Wolansky
Prof. & Head, Department of Industrial
Education and Technology

249
SCHOLARSHIPS

LAGOS

12573

Seceducate

633080

ED/SC/1/81/0506/60

12th Jan., 1983

The Consulate- General of Nigeria,
575 Lexington Avenue,
New York, N.Y 10022
U S A.

Re: Mr. John Nwabueze Ogbazi
Approval for Research Trip

I am directed to refer to the above and to inform you that the scholar's research trip to Nigeria has been approved.

I am to request you therefore to issue him the ticket and pay him the standard allowance for the thesis.

A. C. Chiboka (mrs),
for:Permanent Secretary.

Copy to:

Mr. John N. Ogbazi,
Department of Industrial Education,
Iowa State University,
Ames, Iowa 50011.

Above for your information, please.

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SIGMA XI, THE SCIENTIFIC RESEARCH SOCIETY

OFFICE OF THE
COMMITTEE ON GRANTS-IN-AID OF RESEARCH

23 March 1983

345 WHITNEY AVENUE
NEW HAVEN, CONNECTICUT 06511
(203) 624-9883

Mr. John N. Ogbazi
128E University Village
Ames, IA 50010

Dear Mr. Ogbazi:

At the recent meeting of the Committee on Grants-in-Aid of Research, the total amount of money asked for by all applicants was much more than we had available to award.

Careful consideration was given to your application, and it is with real regret that I must tell you that the Committee was unable to fund a grant to you.

The Committee hopes that you will be able to secure from other sources the funds you need to maintain your research program.

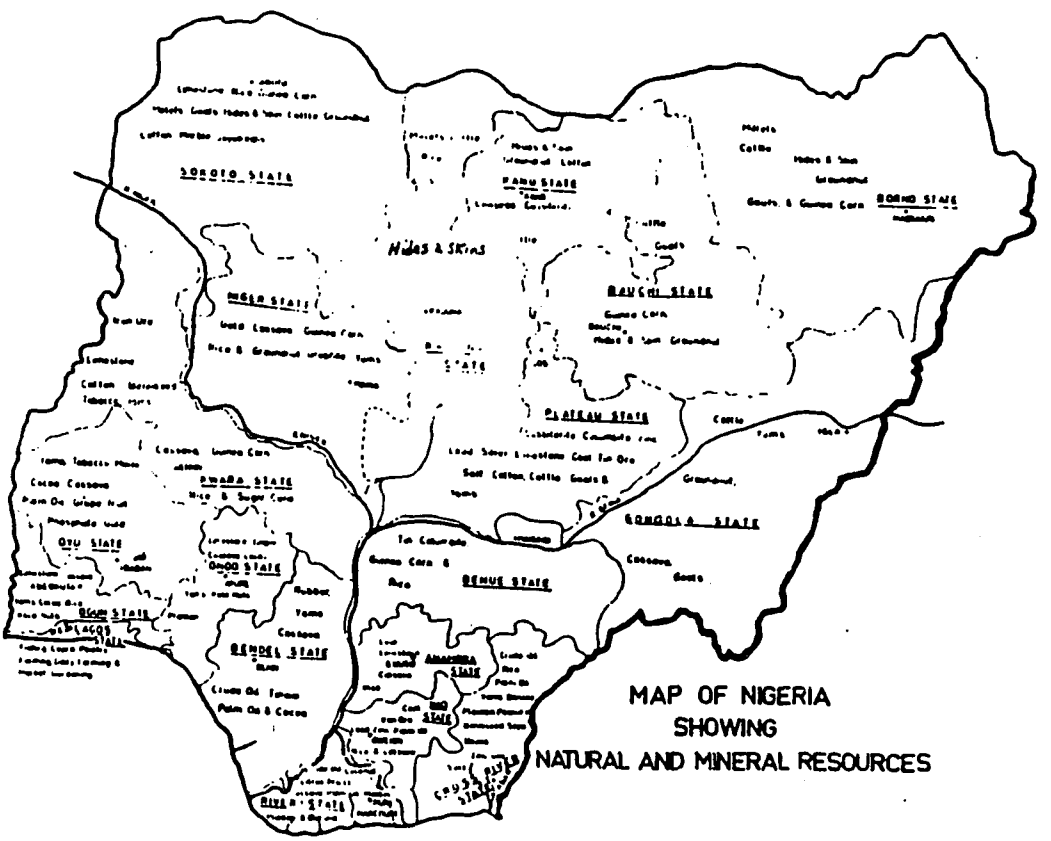
Sincerely yours,

M. Patricia Morse

M. Patricia Morse, Ph.D.
Chairperson

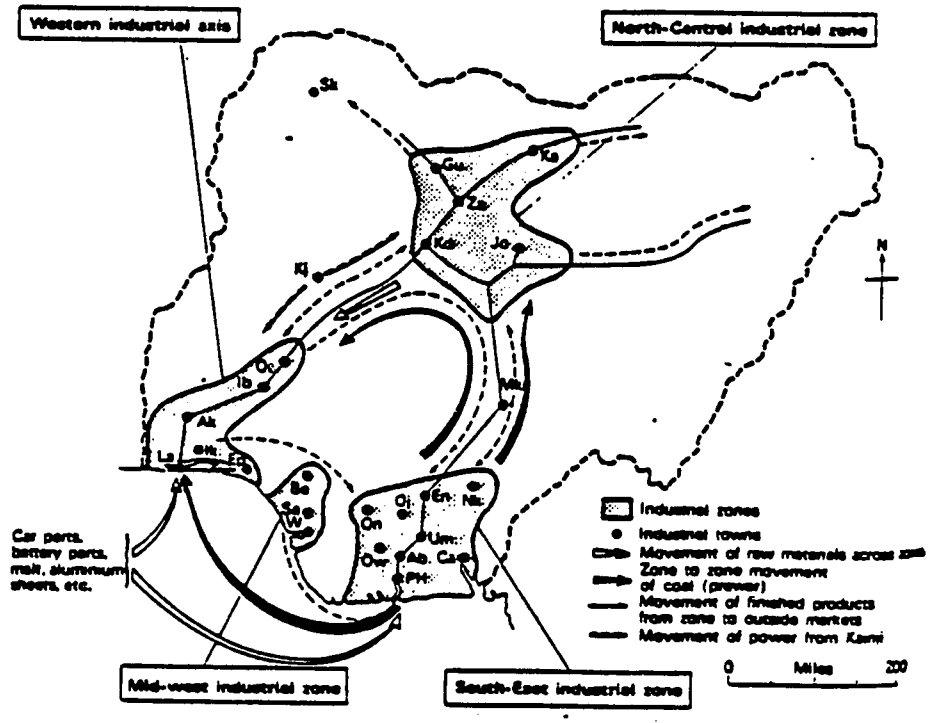
MPM/ia

APPENDIX C. MAPS OF NIGERIA: NATURAL AND MINERAL RESOURCES, AND INDUSTRIAL ZONES



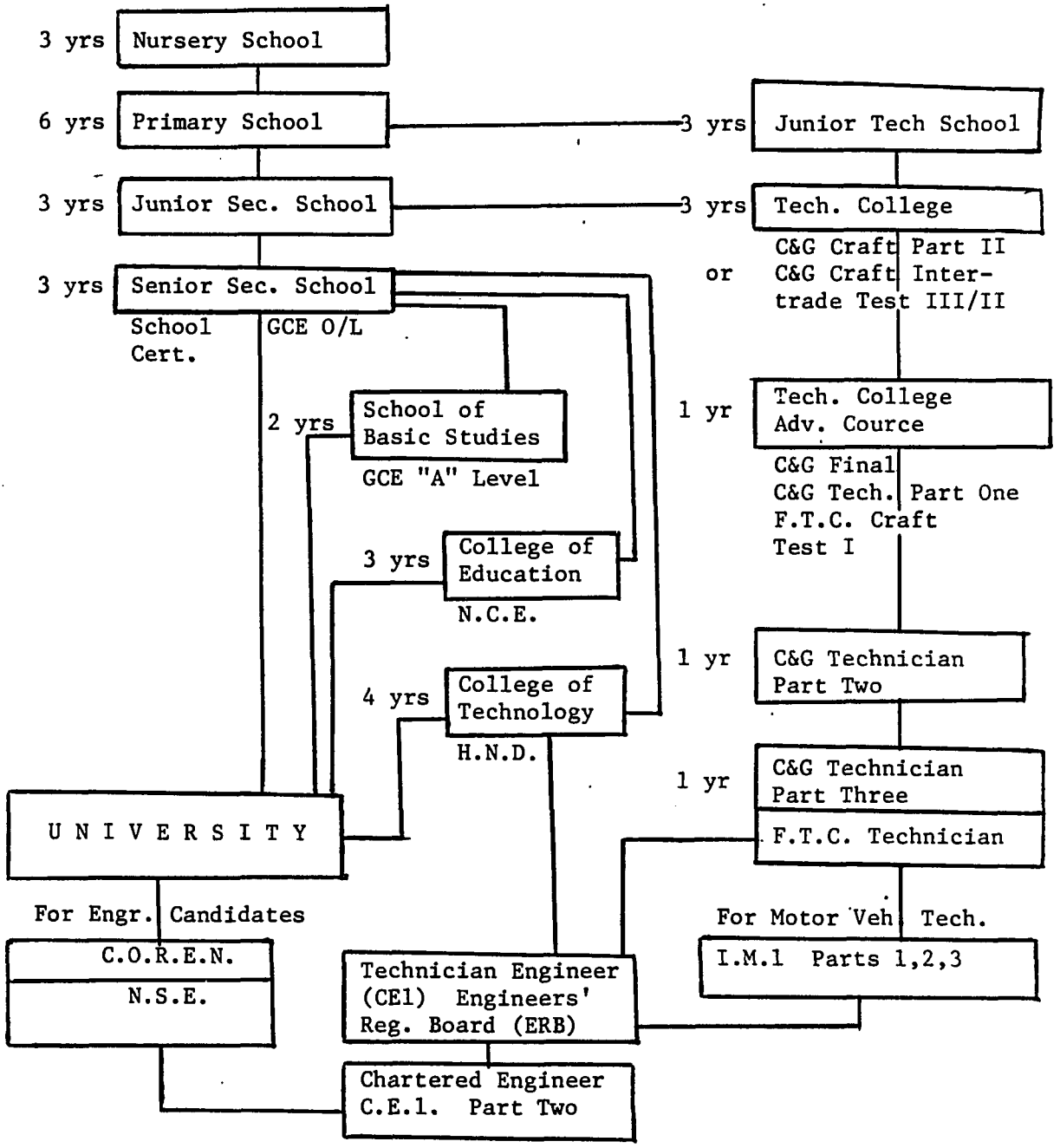
MAP OF NIGERIA
SHOWING
NATURAL AND MINERAL RESOURCES

INDUSTRIAL MAP OF NIGERIA



APPENDIX D. NIGERIAN EDUCATIONAL SYSTEM

Nigerian System of Education as of September 1982
(C.O.R.E.N. = Council of Registered Engineers of Nigeria; N.S.E. = Nigerian Society of Engineers; N.C.E. = National Certificate in Education; H.N.D. = Higher National Diploma)



APPENDIX E. ANALYSIS OF VARIANCE TABLE RELATED TO QUESTION 1 OF THE STUDY

Table E1. Analysis of variance table relating to the curriculum approaches to be emphasized in the industrial technology programs in Nigeria

Item	Source	df	Sum of squares	Mean squares	F
9	Between	3	13.947	4.649	5.564*
	Within	129	107.782	0.836	
10	Between	3	14.937	4.979	7.025*
	Within	129	91.424	0.709	
11	Between	3	10.616	3.539	4.957*
	Within	129	92.090	0.714	
12	Between	3	2.605	0.864	1.479
	Within	129	75.755	0.587	
13	Between	3	1.867	0.623	1.178
	Within	129	68.207	0.529	
14	Between	3	1.869	0.623	1.178
	Within	129	68.207	0.529	
15	Between	3	20.816	6.938	5.789*
	Within	129	154.627	1.199	
16	Between	3	10.325	3.442	3.330*
	Within	129	133.344	1.034	
17	Between	3	12.817	4.272	4.744*
	Within	129	116.175	0.901	
18	Between	3	2.962	0.987	1.606
	Within	129	79.294	0.615	
19	Between	3	31.597	10.532	11.367*
	Within	129	119.501	0.926	
20	Between	3	40.849	13.617	9.683*
	Within	129	181.406	1.406	
21	Between	3	6.393	2.131	2.394
	Within	129	114.840	0.890	

*Significant at 0.05 level.

Table E1. (Continued)

Item	Source	df	Sum of squares	Mean squares	F
22	Between	3	12.752	4.251	3.725*
	Within	129	147.217	1.141	
23	Between	3	11.796	3.932	4.623*
	Within	129	109.722	0.851	
24	Between	3	7.970	2.657	3.163*
	Within	129	108.331	0.840	
25	Between	3	24.052	8.017	10.810*
	Within	129	95.677	0.742	
26	Between	3	14.763	4.921	4.524*
	Within	129	140.334	1.088	
27	Between	3	9.291	3.097	2.923*
	Within	129	136.679	1.060	
28	Between	3	2.210	0.737	0.968
	Within	129	98.151	0.761	
29	Between	3	4.920	1.640	1.365
	Within	129	154.959	1.201	
30	Between	3	6.661	2.220	2.710*
	Within	129	105.624	0.819	
31	Between	3	7.703	2.568	2.500
	Within	129	132.582	1.028	
32	Between	3	6.671	2.224	2.190
	Within	129	130.997	1.016	
33	Between	3	13.805	4.602	5.302**
	Within	129	111.969	0.868	
34	Between	3	11.316	3.772	2.394
	Within	129	203.255	1.576	
35	Between	3	30.812	10.270	8.444*
	Within	129	156.916	1.216	
36	Between	3	6.312	2.104	2.447
	Within	129	110.922	0.860	

Table E1. (Continued)

Item	Source	df	Sum of squares	Mean squares	F
37	Between	3	4.605	1.535	2.577
	Within	129	76.839	0.596	
38	Between	3	5.713	1.905	2.228
	Within	129	110.286	0.855	
39	Between	3	9.752	3.251	3.028*
	Within	129	138.503	1.074	
40	Between	3	19.299	6.433	6.486*
	Within	129	127.948	0.992	
41	Between	3	5.491	1.830	1.693
	Within	129	139.501	1.081	
42	Between	3	2.463	0.821	0.898
	Within	129	117.928	0.914	
43	Between	3	3.054	1.018	1.018
	Within	129	129.036	1.000	
44	Between	3	19.755	6.585	7.721*
	Within	129	110.018	0.853	
45	Between	3	7.535	2.512	2.261
	Within	129	143.276	1.111	
46	Between	3	15.926	5.309	4.486*
	Within	129	152.645	1.183	
47	Between	3	7.992	2.664	2.458
	Within	129	139.797	1.084	
48	Between	3	10.308	3.436	3.321*
	Within	129	133.466	1.035	
49	Between	3	4.649	1.549	1.206
	Within	129	165.712	1.285	
50	Between	3	3.137	1.046	0.960
	Within	129	140.545	1.090	
51	Between	3	6.146	2.049	2.177
	Within	129	121.373	0.941	

APPENDIX F. ANALYSIS OF VARIANCE TABLE RELATED TO QUESTION 2 OF THE STUDY

Table F1. Analysis of variance table relating to the occupational areas to be emphasized in the industrial technology programs in Nigeria

Item	Source	df	Sum of squares	Mean squares	F
52	Between	3	10.262	3.421	5.393*
	Within	129	81.828	0.634	
53	Between	3	9.168	3.056	4.081*
	Within	129	96.607	0.749	
54	Between	3	25.172	8.391	10.098*
	Within	129	107.188	0.831	
55	Between	3	4.613	1.538	1.599
	Within	129	124.093	0.962	
56	Between	3	4.810	1.603	1.769
	Within	129	116.919	0.906	
57	Between	3	2.304	0.768	1.144
	Within	129	86.643	0.672	
58	Between	3	0.587	0.1956	0.370
	Within	129	68.240	0.529	
59	Between	3	10.258	3.419	4.617*
	Within	129	95.531	0.741	
60	Between	3	5.507	1.836	2.682*
	Within	129	88.282	0.684	
61	Between	3	23.976	7.992	10.299*
	Within	129	100.099	0.776	
62	Between	3	20.991	6.997	7.943*
	Within	129	113.640	0.881	
63	Between	3	13.257	4.419	4.571*
	Within	129	124.713	0.967	
64	Between	3	5.384	1.795	2.022
	Within	129	114.495	0.888	

*Significant at 0.05 level.

Table F1. (Continued)

Item	Source	df	Sum of squares	Mean squares	F
65	Between	3	6.423	2.141	3.610
	Within	129	76.509	0.593	
66	Between	3	10.818	3.606	6.432*
	Within	129	72.325	0.561	
67	Between	3	5.246	1.749	2.217
	Within	129	101.747	0.789	
68	Between	3	4.561	1.520	3.047*
	Within	129	64.371	0.499	
69	Between	3	7.907	2.636	3.846*
	Within	129	88.394	0.685	
70	Between	3	11.481	3.827	7.749*
	Within	129	63.722	0.494	
71	Between	3	19.884	6.628	8.889*
	Within	129	96.191	0.746	
72	Between	3	17.888	5.963	2.433
	Within	129	316.187	2.451	

APPENDIX G. ANALYSIS OF VARIANCE TABLE RELATED TO QUESTION 3 OF THE STUDY

Table G1. Analysis of variance table related to the evaluation components of the industrial technology programs

Item	Source	df	Sum of squares	Mean squares	F
73	Between	3	6.462	2.154	4.195*
	Within	129	66.245	0.514	
74	Between	3	10.458	3.486	5.773*
	Within	129	77.903	0.604	
75	Between	3	5.968	1.989	3.330*
	Within	129	77.055	0.597	
76	Between	3	10.065	3.355	4.431*
	Within	129	97.664	0.757	
77	Between	3	6.036	2.012	3.691*
	Within	129	70.324	0.545	
78	Between	3	5.749	1.917	1.923
	Within	129	128.551	0.997	
79	Between	3	10.278	3.426	4.729*
	Within	129	93.451	0.724	
80	Between	3	3.820	1.273	1.795
	Within	129	91.488	0.709	
81	Between	3	10.914	3.638	4.319*
	Within	129	108.649	0.842	
82	Between	3	5.641	1.880	2.044
	Within	129	118.645	0.919	
83	Between	3	9.636	3.212	3.169*
	Within	129	130.755	1.014	
84	Between	3	4.990	1.663	2.386
	Within	129	89.927	0.697	

*Significant at 0.05 level.

Table G1. (Continued)

Item	Source	df	Sum of squares	Mean squares	F
85	Between	3	16.646	5.549	4.437*
	Within	129	161.323	1.251	
86	Between	3	3.801	1.267	1.787
	Within	129	91.446	0.709	
87	Between	3	2.182	0.727	1.284
	Within	129	73.066	0.566	
88	Between	3	3.481	1.160	1.751
	Within	129	85.466	0.663	

APPENDIX H. COMPUTER PROGRAM FOR DATA ANALYSIS (SPSS)

```
//D332  JOHN  JOB I7195, OGBAZI
/*KEY   JOHN
//S1 EXEC SPSS
//SYSIN  DD*
RUN  NAME    JOHN OGBAZI'S DISSERTATION APRIL 1983
VARIABLE LIST  GROUP, SEX, CLASS, STEM, STOR, AGE, LEVEL,
               YEARS EXP,  EMP, CA9 to CA51, A052 TO A072,
               EPA73 to EPA79, GROUP2, EPB80 to EPB88

INPUT FORMAT   FIXED(80F1.0/10F1.0)
N OF CASES     133
INPUT MEDIUM   CARD
COMPUTE        GRCK = GROUP - GROUP 2
FREQUENCIES    GENERAL = GROUP TO EPB88
READ INPUT DATA


FINISH
//
ONEWAY         CA9 to EPB88 BY GROUP(1,4)/
               RANGES = SCHEFFE (.05)/
STATISTICS     1
```

APPENDIX I. PRESENT MANPOWER SHORTAGES IN NITERIA[1]

	Category of manpower	Present shortages
1.	Architects	620
2.	Accountants	2,650
3.	Town planners	350
4.	Civil and structural engineering	4,700
5.	Builders	240
6.	Electrical/electronic engineers	2,070
7.	Agricultural engineers	260
8.	Land surveyors	350
9.	Quality surveyors	220
10.	Estate surveyors	250
11.	Geologists and geophysicists	370
12.	Architectural technicians	1,220
13.	Civil engineering technicians	5,950
14.	Electrical/electronic engineering technicians	8,060
15.	Medical doctors	4,830
16.	Dentists	286
17.	Pharmacists	1,690
18.	Veterinary surgeons	505
19.	Nurses and midwives	21,430
20.	Medical laboratory technologists	640
21.	Radiographers	190
22.	Agricultural officers	1,440
23.	Agricultural assistants	2,040
24.	Statisticians	370
25.	Administrative officers	2,370
26.	Executive officers	2,270
27.	Librarians	850
28.	Legal practitioners	2,260

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[1]Source: Federal Ministry of National Planning (1981, pp. 428-429).